# LONDON-WEST MIDLANDS ENVIRONMENTAL STATEMENT

## Volume 5 | Technical Appendices

CFA7-15 | Colne Valley to Lower Boddington

**Ecological baseline data: invertebrates and fish (EC-004-002)**

Ecology

November 2013

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Department for Transport

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# Volume 5: baseline report - EC-004-002

# Ecological baseline data (CFA 7-15)

## Invertebrates and fish

# 1 Introduction

1.1.1 This document is an appendix which forms part of Volume 5 of the environmental statement (ES) for the Proposed Scheme. It details ecological baseline data collected for the following ecological aspects and species:

- Terrestrial invertebrates;
- Aquatic invertebrates;
- White clawed crayfish; and
- Fish.

1.1.2 The ecological baseline data detailed within this document relates to community forum areas (CFA):

- CFA7: Colne Valley;
- CFA8: The Chalfonts and Amersham;
- CFA9: Central Chilterns;
- CFA10: Dunsmore, Wendover and Halton;
- CFA11: Stoke Mandeville and Aylesbury;
- CFA12: Waddesdon and Quainton;
- CFA13: Calvert, Steeple Claydon, Twyford and Chetwode;
- CFA14: Newton Purcell to Brackley; and
- CFA15: Greatworth to Lower Boddington.

1.1.3 The document should be read in conjunction with Volume 2 (community forum area reports), Volume 3 (route wide effects assessment) and Volume 4 (off-route effects assessment).

# 2 Terrestrial Invertebrates

## 2.1 Introduction

2.1.1 This section of the appendix presents a summary of baseline data relating to terrestrial invertebrates for the section of the land required for the construction of the Proposed Scheme that will pass through CFA7 to 15 inclusive.

## 2.2 Methodology

2.2.1 Details of the standard methodology utilised for terrestrial surveys are provided in the Technical Note HS2 Ecological Surveys: Field Survey Methods and Standards (FSMS) which is included as an appendix to Volume 1.

2.2.2 In addition to surveys of specific sites judged to be of high potential value for invertebrates, some survey work was also carried out within sites representative of the agricultural habitat within land required for construction of the Proposed Scheme. Following the approach outlined in the FSMS, the requirement for detailed invertebrate surveys has been based on:

- the results of a desk study;
- interpretation of aerial photography and Phase 1 surveys to identify habitats that may be suitable for breeding or that may be important for maintenance of at least one part of an invertebrate's life cycle (e.g. foraging habitat, overwintering habitat for eggs/larvae etc);
- feedback and discussion with the county recorders for Buckinghamshire (1 November 2012); and
- an invertebrate walkover scoping survey.

2.2.3 Desk study records relating to terrestrial invertebrates for the land required for the construction of the Proposed Scheme were obtained from Buckinghamshire and Milton Keynes Environmental Records Centre.

2.2.4 Along much of the route corridor the data search has been analysed to within 100m of land required for the construction of the Proposed Scheme, although a greater distance is considered where appropriate (up to 5km).

2.2.5 The status of species of conservation concern was taken from the Joint Nature Conservation Committee database of species designations[1] or for a number of taxa (principally spiders) from other respected sources.

2.2.6 Notable species, i.e. those of conservation concern, are defined as follows:

- Nationally Notable - species known or likely to be present within 16 to 100 10-km squares of the Ordnance Survey National Grid in the UK; for a number of

[1] Joint Nature Conservation Committee; http://jncc.defra.gov.uk/page-340; Accessed October 2013.

species this is further refined as -A or -B according to range: -A is assigned to species thought to occur in 30 or fewer 10-km squares of the National Grid; and -B for species thought to occur in 31 to 100 10-km squares of the National Grid. The following abbreviations are used: Nationally Notable is abbreviated as Notable; Nationally Notable A as Notable-A and Nationally Notable B as Notable-B;

- Nationally Scarce – a term now largely superseding Nationally Notable and defined as species in 16-100 10-km squares of the National Grid. Nationally Scarce is abbreviated as NS;
- Red Data Book species – species occurring in fewer than 16 10-km squares of the National Grid, divided as: Endangered (Red Data Book 1),for species known from a single population or in continuous recent decline and now known from five or fewer 10-km squares; Vulnerable (Red Data Book 2), likely to become Endangered (Red Data Book 1) if causal factors continue; Rare (Red Data Book 3), species at risk but not qualifying as Vulnerable; and Red Data Book K, species Insufficiently Known but likely to qualify at least as Rare. These are respectively abbreviated as RDB 1, RDB 2, RDB 3 and RDB K; and
- Species of principal importance as listed in Section 41 of the National Environment and Rural Communities Act, 2006. These are abbreviated as NERC-S41.

2.2.7 Survey work was undertaken primarily in May and June 2013 with some sites also visited in July. A small number of sites were visited in late July and October 2012, but these surveys concluded that additional survey work in the spring and early summer periods was justified. In the Greatmoor / Calvert area a number of butterfly transects were undertaken in June and July 2012, specifically for the black hairstreak (*Satyrium pruni*).

2.2.8 The sampling methods for each habitat followed those proposed by Drake *et al*. (2007)[2], largely based on sweep netting and hand searching. Each site was subject to a visual appraisal with one or more stations selected for direct survey. The number of stations was decided according to the size of the site, variety of habitats, and the likely species and their importance. At each station, sampling was undertaken for 50 minutes comprising 30-minutes hand searching and 20 minutes netting, although this was modified according to the professional judgement of the surveyor. The range of species surveyed largely comprised the target taxa listed by Drake *et al*. (2007).

2.2.9 The site inventories are not considered to be comprehensive enough for a full assessment of site condition using the Invertebrate Species-habitat Information System (ISIS) of Natural England. However, ISIS is used to allocate species to assemblage types and to allow a standardised comparison of the habitats of importance at sites. Thus, where species are listed within ISIS then their broad

[2] Drake, C.M., Lott, D.A., Alexander, K.N.A. & Webb, J. (2007) *Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation*. Natural England, Sheffield.

assemblage type and, for the more specialist species, any specific assemblage type, is given. For species not included in ISIS the habitat requirements were taken from authoritative field guides or other literature.

2.2.10 Table 1 summarises those locations where survey(s) for terrestrial invertebrates were undertaken. This information is cross referenced to the accompanying map series EC-004-002.

Table 1: Summary of terrestrial invertebrate field surveys undertaken

| Ecology survey code | Survey site name | Location | Centroid OS Grid Reference | Habitat types included in survey | Survey date(s) | CFA number | Approximate distance from the land required for the construction of the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|---|---|
| 020-IT1-028-001 | Mid Colne Valley SSSI | Denham | TQ038893 | Woodland and woodland edge | 22 July 2012, 24 October 2012, 13 May 2013, 5 June 2012, 2 July 2013 | 7 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-042-001 | Shardeloes Lake | Amersham | SU939981 | Tall fen, wetland margins | 10 June 2013, 1 July 2013 | 8 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-044-001 | Mantle's Wood | Little Missenden | SP921000 | Woodland, woodland edge | 22 May 2013, 6 June 2013 | 9 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-046-001<br>020-IT1-046-002 | Sibley's Coppice | South Heath | SP909016 | Woodland, woodland edge | 22 July 2012, 24 October 2012, 13 May 2013, 5 June 2013 | 9 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-053-001<br>020-IT1-052-001 | Bacombe | Wendover | SP870069 | Grassland and scrub matrix, short sward grassland | 16 May 2013, 4 July 2013 | 10 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-055-001 | Wellwick | Stoke Mandeville | SP850083 | Grassland, hedgerow and scrub matrix | 14 June 2013 | 10 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-056-001 | The orchard north of Nash Lee Road | Stoke Mandeville | SP846090 | Orchard trees with dead wood, semi-improved grassland, hedgerows | 24 October 2013, 14 May 2013, 12 June 2013, 1 July 2013 | 10 | Within the land required for the construction of the Proposed Scheme |

| Ecology survey code | Survey site name | Location | Centroid OS Grid Reference | Habitat types included in survey | Survey date(s) | CFA number | Approximate distance from the land required for the construction of the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|---|---|
| 020-IT1-057-001 | Stoke House Farm | Stoke Mandeville | SP837095 | Semi-improved grassland, hedgerows | 21 May 2013, 7 June 2013 | 11 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-063-001 | Aylesbury Park Golf Club | Aylesbury | SP796131 | Wet grassland, pond margins and mature trees | 21 May 2013, 12 June 2013 | 11 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-074-001 | Finemere Railway | Greatmoor | SP710216 | Grassland and scrub matrix | 20 May 2013, 1 July 2013, 3 July 2013 | 12 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-075-001 | Finemere Grassland | Greatmoor | SP716214 | Semi-improved grassland | 24 October 2013, 6 June 2013, 3 July 2013 | 12 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-076-001 | Calvert Mega Ditch | Greatmoor | SP704224 | Grassland and scrub matrix, short sward grassland | 6 June 2013 | 12 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-078-001 | Calvert Complex: Landfill | Calvert | SP686248 | Grassland and scrub matrix, short sward grassland, damp grassland | 21 May 2013, 4 July 2013 | 13 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-079-001 | Calvert Complex: Calvert Bank | Calvert | SP682538 | Grassland and scrub matrix, short sward grassland | 26 July 2012, 23 October 2012, 15 May 2013, 6 June 2013 | 13 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-079-001 | Calvert Complex: Calvert Brownfield | Calvert | SP682253 | Grassland and scrub matrix, short sward grassland | 26 July 2012, 23 October 2012, 15 May 2013, 6 June 2013 | 13 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-079-002 | Calvert Complex: Calvert Rail Station | Calvert | SP689246 | Grassland and scrub matrix, short sward grassland | 14 May 2013, 7 June 2013 | 13 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-080-001 | Calvert Complex: | Calvert | SP677253 | Grassland and scrub matrix, short sward | 15 May 2013, 6 June 2013 | 13 | Within the land required for the construction of the |

| Ecology survey code | Survey site name | Location | Centroid OS Grid Reference | Habitat types included in survey | Survey date(s) | CFA number | Approximate distance from the land required for the construction of the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|---|---|
| | Grebe Lake | | | grassland | | | Proposed Scheme |
| 020-IT1-087-001<br>020-IT1-087-002 | Barton Hartshorn south-west of Buckingham | Barton Hartshorn | SP632302 | Grassland, hedgerow and scrub matrix, pond | 14 May 2013, 11 June 2013 | 13 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-089-001 | Finmere Quarry | Finmere | SP627322 | Grassland and scrub matrix, short sward grassland | 3 July 2013 | 14 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-097-001 | Helmdon Disused Railway SSSI | Helmdon | SP590398 | Grassland and scrub matrix | 11 June 2013 | 14 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-099-001 | Halse Copse | Helmdon | SP575415 | Woodland and woodland edge | 21 July 2012, 24 October 2012, 15 May 2013, 6 June 2013 | 14 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-104-001 | Bull's Lane | Thorpe Mandeville | SP537447 | Grassland, hedgerow and scrub matrix | 11 June 2013 | 15 | 43 north-west |
| 020-IT1-106-001 | Culworth, near Thorpe Mandeville | Thorpe Mandeville | SP534461 | Grassland and scrub matrix, short sward grassland | 15 May 2013, 5 June 2013 | 15 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-112-001 | Manor Farm, Aston-le-Wells | Aston-le-Wells | SP486503 | Semi-improved grassland, hedgerows, pond margins | 23 May 2013, 11 June 2013 | 15 | Within the land required for the construction of the Proposed Scheme |
| 020-IT1-116-001 | Fox Covert | Wormleighton | SP462535 | Woodland, woodland edge | 26 July 2013, 23 October 2013, 15 May 2013, 5 June 2013 | 15 | Within the land required for the construction of the Proposed Scheme |

## 2.3 Deviations, constraints and limitations

2.3.1 Surveys were undertaken largely following the guidelines as stated in the FSMS Section 10. As far as possible, surveys were carried out on sunny, clear days with light

wind, although the poor weather in the April to June period of 2013 hampered the survey programme, and some surveys were undertaken in sub-optimal conditions. Where surveys in sub-optimal conditions were undertaken on sites visually appraised as being of high potential value, these were re-visited in July 2013. Traps were not deployed to supplement the hand survey methods, due to the poor weather and uncertainties over access. Nevertheless, it is considered that the data provide a good representation of the species present, and allow an objective measure of site value sufficient for the purposes of this assessment.

2.3.2 Whilst every effort was made to establish an inventory that was as complete as possible for each site, it is accepted that more species could be recorded with additional visits and at other times of year. Nevertheless, it is considered that the surveys are robust for the purposes of site and impact assessment.

2.3.3 Surveys undertaken were limited to locations where landowner permission had been obtained. The need for voucher specimens to be collected meant no survey work was undertaken from public rights of way where permission was lacking. On a small number of sites where access was granted for surveys there were some further restrictions, principally applying to areas of mineral and aggregate workings.

## 2.4 Baseline

2.4.1 Table 2 provides a summary of those sites that were subject to initial scoping surveys, and were found not to warrant further detailed survey.

Table 2: Sites scoped out of requirement for further terrestrial invertebrate survey

| Ecology survey code | Survey site/location | OS grid reference | Description of proposed site and rationale for scoping out requirement for further survey | Survey date | CFA |
|---|---|---|---|---|---|
| 020-IT1-028-002 | Mid Colne Valley SSSI | TQ047885 | Areas affected by historic gravel extraction and with young woodland cover | 22 July 2012 | 7 |

2.4.2 Table 3 provides a summary of protected and/or notable invertebrate species identified within CFA7 to 15 inclusive.

Table 3: Protected and/or notable invertebrate species identified during terrestrial invertebrate survey in CFA7 to 15 inclusive

| Ecology Survey Code | Latin name | Status | Survey site/location | Habitat | Survey date(s) | CFA |
|---|---|---|---|---|---|---|
| 020-IT1-028-001 | *Ischnomera cyanea* | Notable-B | Mid Colne Valley SSSI | Wood decay, heartwood decay | 5 June 2013 | 7 |
| 020-IT1-028-001 | *Ischnomera sanguinicollis* | Notable-B | Mid Colne Valley SSSI | Wood decay, heartwood decay | 5 June 2013 | 7 |
| 020-IT1-028-001 | *Aulonothroscus brevicollis* | RDB 3 | Mid Colne Valley SSSI | Wood decay, heartwood decay | 2 July 2013 | 7 |
| 020-IT1- | *Ctenophora* | RDB 2 | Mid Colne Valley | Wood decay, heartwood | 13 May 2013 | 7 |

| Ecology Survey Code | Latin name | Status | Survey site/location | Habitat | Survey date(s) | CFA |
|---|---|---|---|---|---|---|
| 028-001 | *flaveolata* | | SSSI | decay | | |
| 020-IT1-042-001 | *Hilara lugubris* | NS | Shardeloes Lake | Stream and river margin | 10 June 2013 | 8 |
| 020-IT1-044-001 | *Scaphidema metallicum* | NS | Mantle's Wood | Wood decay, bark and sapwood decay | 22 May 2013 | 9 |
| 020-IT1-044-001 | *Stenus fuscicornis* | Notable-B | Mantle's Wood | Grassland and scrub matrix | 22 May 2013 | 9 |
| 020-IT1-044-001 | *Anaglyptus mysticus* | Notable-B | Mantle's Wood | Wood decay, bark and sapwood decay | 6 June 2013 | 9 |
| 020-IT1-044-001 | *Dryodromya testacea* | NS | Mantle's Wood | Possibly dead wood | 22 May 2013, 6 June 2013 | 9 |
| 020-IT1-046-001 | *Fannia metallipennis* | Notable | Sibley's Coppice | Animal nests | 5 June 2013 | 9 |
| 020-IT1-046-001 | *Dryodromya testacea* | NS | Sibley's Coppice | Possibly dead wood | 13 May 2013, 5 June 2013 | 9 |
| 020-IT1-056-001 | *Prionychus ater* | Notable-B | The orchard north of Nash Lee Road | Wood decay, heartwood decay | 12 June 2013 | 10 |
| 020-IT1-056-001 | *Ischnomera cyanea* | Notable-B | The orchard north of Nash Lee Road | Wood decay, heartwood decay | 12 June 2013 | 10 |
| 020-IT1-056-001 | *Ampedus elongantulus* | Notable-A | The orchard north of Nash Lee Road | Wood decay, heartwood decay | 12 June 2013 | 10 |
| 020-IT1-056-001 | *Rhinocyllus conicus* | Notable-A | The orchard north of Nash Lee Road | Unshaded early successional mosaic | 12 June 2013 | 10 |
| 020-IT1-056-001 | *Fannia nidica* | Notable | The orchard north of Nash Lee Road | Animal nests | 12 June 2013 | 10 |
| 020-IT1-057-001 | *Eggisops pecchiolii* | Notable | Stoke House Farm | Grassland and scrub matrix | 7/6/2013 | 11 |
| 020-IT1-063-001 | *Hedobia imperialis* | Notable-B | Aylesbury Park Golf Club | Wood decay, heartwood decay | 12 June 2013 | 11 |
| 020-IT1-063-001 | *Oxystoma cerdo* | Notable-B | Aylesbury Park Golf Club | Grassland and scrub matrix | 12 June 2013 | 11 |
| 020-IT1-063-001 | *Acupalpus exiguus* | Notable-B | Aylesbury Park Golf Club | Riparian sand | 12 June 2013 | 11 |
| 020-IT1-063-001 | *Anthracus consputus* | Notable-B | Aylesbury Park Golf Club | Mineral marsh and open water | 12 June 2013 | 11 |
| 020-IT1-063-001 | *Pterostichus anthracinus* | Notable-B | Aylesbury Park Golf Club | Mineral marsh and open water | 12 June 2013 | 11 |
| 020-IT1-063-001 | *Phytoecia cylindrica* | Notable-B | Aylesbury Park Golf Club | Grassland and scrub matrix | 12 June 2013 | 11 |

| Ecology Survey Code | Latin name | Status | Survey site/location | Habitat | Survey date(s) | CFA |
|---|---|---|---|---|---|---|
| 020-IT1-063-001 | *Microplontus campestris* | Notable-B | Aylesbury Park Golf Club | Unshaded early successional mosaic | 12 June 2013 | 11 |
| 020-IT1-063-001 | *Ischnomera cyanea* | Notable-B | Aylesbury Park Golf Club | Wood decay, heartwood decay | 12 June 2013 | 11 |
| 020-IT1-063-001 | *Polistichus connexus* | Vulnerable (RDB2) | Aylesbury Park Golf Club | Riparian sand | 12 June 2013 | 11 |
| 020-IT1-063-001 | *Lasius brunneus* | Notable-A | Aylesbury Park Golf Club | Wood decay, heartwood decay | 12 June 2013 | 11 |
| 020-IT1-075-001 | *Hypera meles* | Notable-A | Finemere Grassland | Grassland and scrub matrix | 6 June 2013 | 12 |
| 020-IT1-075-001 | *Phrurolithus minimus* | Notable-A | Finemere Railway | Grassland and scrub matrix | 3 July 2013 | 12 |
| 020-IT1-075-001 | *Hygrolycosa rubrofasciata* | Notable-A | Finemere Railway | Permanent wet mire | 3 July 2013 03/7/2013 | 12 |
| 020-IT1-075-001 | *Mangora acalypha* | Notable-B | Finemere Railway | Grassland and scrub matrix | 20/5/2013 | 12 |
| 020-IT1-075-001 | *Trachyzelotes pedestris* | Notable-B | Finemere Railway | Grassland and scrub matrix | 20/5/2013 | 12 |
| 020-IT1-075-001 | *Ozyptila simplex* | Notable-B | Finemere Railway | Unshaded early successional mosaic, bare sand and chalk | 20/5/2013 | 12 |
| 020-IT1-075-001 | *Pterostichus longicollis* | Notable-B | Finemere Railway | Mineral marsh and open water | 3 July 2013 | 12 |
| 020-IT1-075-001 | *Cryptocephalus bipunctatus* | Notable-B | Finemere Railway | Unshaded early successional mosaic, open short sward | 3 July 2013 | 12 |
| 020-IT1-075-001 | *Microplontus campestris* | Notable-B | Finemere Railway | Unshaded early successional mosaic | 20/5/2013 | 12 |
| 020-IT1-075-001 | *Stenocarus ruficornis* | Notable-B | Finemere Railway | Unshaded early successional mosaic | 3 July 2013 | 12 |
| 020-IT1-075-001 | *Tyria jacobaeae* | NERC-S41 | Finemere Railway | Widespread where Senecio jacobaea is present as a larval host | 3 July 2013 | 12 |
| 020-IT1-075-001 | *Allophyes oxyacanthae* | NERC-S41 | Finemere Railway | Arboreal canopy | 20 May 2013 | 12 |
| 020-IT1-076-001 | *Agrilus viridis* | Notable-A | Mega Ditch, Calvert | Wood decay, bark and sapwood decay | 6 June 2013 | 12 |
| 020-IT1-076-001 | *Cryptocephalus bipunctatus* | Notable-B | Mega Ditch, Calvert | Unshaded early successional mosaic, open short sward | 6 June 2013 | 12 |

| Ecology Survey Code | Latin name | Status | Survey site/location | Habitat | Survey date(s) | CFA |
|---|---|---|---|---|---|---|
| 020-IT1-078-001 | *Polydrusus formosus* | Notable-A | Calvert Complex: Landfill | Arboreal canopy | 21 May 2013 | 13 |
| 020-IT1-078-001 | *Tachyporus formosus* | Notable-A | Calvert Complex: Landfill | Unshaded early successional mosaic, bare sand and chalk | 21 May 2013 | 13 |
| 020-IT1-078-001 | *Lasius brunneus* | Notable-A | Calvert Complex: Landfill | Wood decay, heartwood decay | 21 May 2013 | 13 |
| 020-IT1-078-001 | *Acupalpus exiguus* | Notable-B | Calvert Complex: Landfill | Riparian sand | 21 May 2013 21/05/2013 | 13 |
| 020-IT1-078-001 | *Bembidion clarkii* | Notable-B | Calvert Complex: Landfill | Litter rich fluctuating marsh | 21 May 2013 | 13 |
| 020-IT1-078-001 | *Pterostichus anthracinus* | Notable-B | Calvert Complex: Landfill | Litter rich fluctuating marsh | 21 May 2013 | 13 |
| 020-IT1-079-001 | *Longitarsus fowleri* | Notable-A | Calvert Complex: Brownfield | Unshaded early successional mosaic, open short sward | 15 May 2013 | 13 |
| 020-IT1-079-001 | *Cryptocephalus aureolus* | Notable-B | Calvert Complex: Brownfield | Unshaded early successional mosaic, open short sward | 6 June 2013 | 13 |
| 020-IT1-079-001 | *Longitarsus dorsalis* | Notable-B | Calvert Complex: Brownfield | Unshaded early successional mosaic, bare sand and chalk | 15 May 2013, 6 June 2013 | 13 |
| 020-IT1-079-001 | *Longitarsus lycopi* | Notable-B | Calvert Complex: Brownfield | Unshaded early successional mosaic, open short sward | 15 May 2013 | 13 |
| 020-IT1-079-001 | *Temnocerus longiceps* | Notable-B | Calvert Complex: Brownfield | Arboreal canopy | 6 June 2013 | 13 |
| 020-IT1-079-001 | *Tyria jacobaeae* | NERC-S41 | Calvert Complex: Brownfield | Widespread where *Senecio jacobaea* is present as a larval host | 6 June 2013 | 13 |
| 020-IT1-079-001 | *Cassida prasina* | Notable-B | Calvert Complex: Bank | Unshaded early successional mosaic, open short sward | 15 May 2013 | 13 |
| 020-IT1-079-001 | *Cryptocephalus aureolus* | Notable-B | Calvert Complex: Bank | Unshaded early successional mosaic, open short sward | 6 June 2013 | 13 |
| 020-IT1-079-001 | *Cryptocephalus bipunctatus* | Notable-B | Calvert Complex: Bank | Unshaded early successional mosaic, open short sward | 6 June 2013 | 13 |
| 020-IT1-079-001 | *Platydracus latebricola* | Notable-B | Calvert Complex: Bank | Unshaded early successional mosaic | 6 June 2013 | 13 |
| 020-IT1- | *Polydrusus formosus* | Notable-A | Calvert Complex: | Arboreal canopy | 7 June 2013 | 13 |

| Ecology Survey Code | Latin name | Status | Survey site/location | Habitat | Survey date(s) | CFA |
|---|---|---|---|---|---|---|
| 079-002 | | | Rail Station | | | |
| 020-IT1-079-002 | *Anaglyptus mysticus* | Notable-B | Calvert Complex: Rail Station | Wood decay, bark and sapwood decay | 7 June 2013 | 13 |
| 020-IT1-079-002 | *Longitarsus nasturtii* | Notable-B | Calvert Complex: Rail Station | Unshaded early successional mosaic, open short sward | 7 June 2013 | 13 |
| 020-IT1-079-002 | *Magdalis cerasi* | Notable-B | Calvert Complex: Rail Station | Wood decay, bark and sapwood decay | 7 June 2013 | 13 |
| 020-IT1-080-001 | *Psacadina verbekei* | Notable | Calvert Complex: Grebe Lake | Permanent wet mire | 15 May 2013 | 13 |
| 020-IT1-080-001 | *Tropistethus holosericeus* | Notable | Calvert Complex: Grebe Lake | Unshaded early successional mosaic, open short sward | 15 May 2013 | 13 |
| 020-IT1-080-001 | *Squamapion cineraceum* | Notable-A | Calvert Complex: Grebe Lake | Unshaded early successional mosaic, open short sward | 15 May 2013 | 13 |
| 020-IT1-080-001 | *Longitarsus fowleri* | Notable-A | Calvert Complex: Grebe Lake | Unshaded early successional mosaic | 15 May 2013 | 13 |
| 020-IT1-080-001 | *Anaglyptus mysticus* | Notable-B | Calvert Complex: Grebe Lake | Wood decay, bark and sapwood decay | 6 June 2013 | 13 |
| 020-IT1-080-001 | *Cryptocephalus bipunctatus* | Notable-B | Calvert Complex: Grebe Lake | Unshaded early successional mosaic | 6 June 2013 | 13 |
| 020-IT1-080-001 | *Longitarsus dorsalis* | Notable-B | Calvert Complex: Grebe Lake | Unshaded early successional mosaic, bare sand and chalk | 15 May 2013, 6 June 2013 | 13 |
| 020-IT1-080-001 | *Tyria jacobaeae* | NERC-S41 | Calvert Complex: Grebe Lake | Widespread where *Senecio jacobaea* is present as a larval host | 6 June 2013 | 13 |
| 020-IT1-087-001 | *Ischnomera cyanea* | Notable-B | Barton Hartshorn | Wood decay, heartwood decay | 14 May 2013, 11 June 2013 | 13 |
| 020-IT1-087-001 | *Grypus equiseti* | Notable-B | Barton Hartshorn | Wetlands where *Equisetum* sp is present as host | 11 June 2013 | 13 |
| 020-IT1-087-001 | *Acupalpus exiguus* | Notable-B | Barton Hartshorn | Riparian sand | 11 June 2013 | 13 |
| 020-IT1-087-001 | *Ptomaphagus varicornis* | RDBK | Barton Hartshorn | Grassland | 11 June 2013 | 13 |
| 020-IT1-089-001 | *Pterostichus oblongopunctatus* | Notable-B | Finmere Quarry | Grassland and scrub matrix | 3 July 2013 | 14 |
| 020-IT1- | *Pipizella virens* | Notable | Finmere Quarry | Grassland and scrub | 3 July 2013 | 14 |

| Ecology Survey Code | Latin name | Status | Survey site/location | Habitat | Survey date(s) | CFA |
|---|---|---|---|---|---|---|
| 089-001 | | | | matrix | | |
| 020-IT1-089-001 | *Bembidion clarkii* | Notable-B | Finmere Quarry | Litter rich fluctuating marsh | 3 July 2013 | 14 |
| 020-IT1-089-001 | *Notaris scirpi* | Notable-B | Finmere Quarry | Mineral marsh and open water | 3 July 2013 | 14 |
| 020-IT1-097-001 | *Rhinocyllus conicus* | Notable-A | Helmdon Disused Railway SSSI | Unshaded early successional mosaic | 11 June 2013 | 14 |
| 020-IT1-097-001 | *Scaphidema metallicum* | Notable-B | Helmdon Disused Railway SSSI | Wood decay, bark and sapwood decay | 11 June 2013 | 14 |
| 020-IT1-099-001 | *Ischnomera cyanea* | Notable-B | Halse Coppice | Wood decay, heartwood decay | 15 May 2013 | 14 |
| 020-IT1-099-001 | *Rhinocyllus conicus* | Notable-A | Halse Coppice | Unshaded early successional mosaic | 15 May 2013 | 14 |
| 020-IT1-106-001 | *Ischnomera cyanea* | Notable-B | Culworth Grounds Farm | Wood decay, heartwood decay | 15 May 2013 | 15 |
| 020-IT1-112-001 | *Stenus butrintensis* | Notable | Manor Farm | Reedfen and pools | 23 May 2013 | 15 |
| 020-IT1-116-001 | *Lasius brunneus* | Notable-A | Fox Covert | Wood decay, heartwood decay | 15 May 2013 | 15 |
| 020-IT1-116-001 | *Ischnomera cyanea* | Notable-B | Fox Covert | Wood decay, heartwood decay | 15 May 2013 , 5 June 2013 | 15 |

## CFA7

### *Notable / Protected Species Recorded*

2.4.3 Field surveys at the Mid Colne Valley SSSI recorded 146 species, of which two have Red Data Book species status and two are Nationally Scarce. The Red Data Book species are *Ctenophora flaveolata* (RDB 2) and *Aulonothroscus brevicollis* (RDB 3), and the scarce species are *Ischnomera cyanea* (Notable-B) and *Ischnomera sanguinicollis* (Notable-B).

### *Summary*

2.4.4 The desk study did not report notable species from within the survey corridor, although stag beetle *Lucanus cervus* is known within 5km and is potentially present.

2.4.5 The woodland of the Mid Colne Valley SSSI was the only site surveyed in CFA7, comprising an area of deciduous woodland with the principal microhabitat of interest being fallen and standing deadwood, the latter largely of silver birch *Betula pendula*. Four species of note were recorded, all associated with wood decay and the heartwood decay specific assemblage type. The survey area comprised the woodland fringe on the western boundary of the Mid Colne Valley SSSI.

## CFA8

### *Notable / Protected Species Recorded*

2.4.6 A single notable species was recorded: *Hilara lugubris* (NS).

### *Summary*

2.4.7 The desk study records of note for CFA8 were from the vicinity of Shardeloes Lake, with a single record for a wetland species, *Platypalpus stabilis* (Notable),and the remainder of the records were for species of principal importance associated with terrestrial vegetation but without strong habitat associations: *Caradrina morpheus* (NERC-S41), *Diarsia rubi* (NERC-S41), *Hoplodrina blanda* (NERC-S41), *Hydraecia micacea* (NERC-S41), *Melanchra persicariae* (NERC-S41), *Scotopteryx chenopodiata* (NERC-S41), *Spilosoma lubricipeda* (NERC-S41), *Tholera decimalis* (NERC-S41) and *Timandra comae* (NERC-S41). Stag beetle is also known from within 5km and may be present along the route corridor.

2.4.8 Only a single site was surveyed within the area, namely the tall fen and marginal wetland vegetation associated with Shardeloes Lake. The only notable (Nationally Scarce) species recorded is associated with damp soil from a range of habitats.

## CFA9

### *Notable / Protected Species Recorded*

2.4.9 Five notable species were recorded, variously classed as Nationally Scarce or Nationally Notable: *Anaglyptus mysticus* (Notable-B), *Dryodromya testacea* (NS), *Fannia metallipennis* (Notable) *Scaphidema metallicum* (NS) and *Stenus fuscicornis* (Notable-B).

### *Summary*

2.4.10 There were no desk study records of notable species within the land required for the construction of the Proposed Scheme in this area, although stag beetle is known within 2km and may be present in dead wood. Two woodland sites were subject to direct survey.

2.4.11 The woodland edge habitat and adjacent field vegetation were sampled at Mantle's Wood, where four notable species were recorded (Nationally Scarce or Nationally Notable). Two of the species are known to be associated with dead wood as part of the bark and sapwood decay specific assemblage type; one with an undefined larval habitat but which may possibly be dead wood, and the other associated with the broad assemblage type of grassland and scrub matrix.

2.4.12 Sibley's Coppice is a small woodland parcel supporting only a very sparse shrub and woodland ground flora, under a dense beech canopy, and there is very little dead wood apparent. Two notable species were recorded (Nationally Scarce and Nationally Notable), with one possibly associated with dead wood and the other associated with animal nests as a larval habitat.

## CFA10

### *Notable / Protected Species Recorded*

2.4.13 Five notable species were recorded, all with Nationally Notable status: *Prionychus ater* (Notable-B), *Ischnomera cyanea* (Notable-B), *Ampedus elongantulus* (Notable-A), *Rhinocyllus conicus* (Notable-A), and *Fannia nidica* (Notable).

### *Summary*

2.4.14 Within the route corridor the desk study returned records of notable species only from the Bacombe area, mainly from the Bacombe Hill and Coombe Hills SSSI. These species were associated with the broad assemblage types of grassland and scrub matrix or unshaded early successional mosaic, with three associated with the open short sward specific assemblage type. These mostly comprise a suite of species of principal importance: *Coenonympha pamphilus* (NERC-S41), *Erynnis tages* (NERC-S41), *Pyrgus malvae* (NERC-S41), *Lasiommata megera* (NERC-S41), and *Shargacucullia lychnitis* (NERC-S41); *Helix pomatia* is also recorded and this is protected under the Wildlife & Countryside Act Schedule 5, Section 9(1), (2) and (5). Stag beetle is also recorded within 5km.

2.4.15 A total of 256 species were recorded within CFA10, of which five are notable. Three sites were surveyed.

2.4.16 North of Nash Lee Road was a large orchard of fruit trees, old, though not veteran, with good quantities of dead and decaying wood present. The ground beneath the trees was heavily grazed by sheep such that there were very few flowering plants to act as nectar sources. All of the notable species within the area were recorded from the orchard of Nash Lee Road: three associated with wood decay and the specific assemblage type of heartwood decay; one with unshaded early successional mosaic; and one with birds' nests.

2.4.17 Two other farmland sites (Bacombe Farm and Wellwick Farm) comprising hedgerows and semi-improved grassland were surveyed. Neither supported notable species. The Bacombe site is in agricultural land near to the Bacombe Hill and Coombe Hill SSSI.

## CFA11

### *Notable / Protected Species Recorded*

2.4.18 Eleven notable species were recorded, comprising one Red Data Book species and ten Nationally Notable or Nationally Scarce species: *Polistichus connexus* (RDB 2), *Eggisops pecchiolii* (Notable), *Hedobia imperialis* (Notable-B), *Oxystoma cerdo* (Notable-B), *Acupalpus exiguus* (Notable-B), *Anthracus consputus* (Notable-B), *Pterostichus anthracinus* (Notable-B), *Phytoecia cylindrica* (Notable-B), *Microplontus campestris* (Notable-B), *Ischnomera cyanea* (Notable-B), and *Lasius brunneus* (Notable-A).

### *Summary*

2.4.19 Within CFA11 403 species were recorded of which 11 are notable. The desk study returned a single notable record from within 100m of the land required for the

construction of the proposed scheme; a dead wood species *Pyrochroa coccinea* (Notable-B) from Hartwell. The stag beetle is also known from within 5km.

2.4.20 Direct surveys at Aylesbury Park Golf Club, which is in the vicinity of Hartwell, recorded ten notable species within the land required for the construction of the Proposed Scheme. This very large site comprised a wide diversity of semi-natural habitats, principally hedgerows, semi-natural woodland and mature parkland trees and wetland margins. The notable species are associated with five broad assemblage types: wood decay; unshaded early successional mosaic; grassland and scrub matrix; flowing water; and mineral marsh and open water. The specific assemblage types represented were: heartwood decay; riparian sand; and litter rich fluctuating marsh. The Red Data Book species *Polistichus connexus* is part of the broad assemblage type associated with 'flowing water' and the specific assemblage type of 'riparian sand'.

2.4.21 Stoke House Farm is a small semi-improved pasture with associated areas of young plantation woodland, hedgerow and rough grassland. The only notable species was Nationally Notable and was associated with the broad assemblage of grassland and scrub matrix.

## CFA12

### *Notable / Protected Species Recorded*

2.4.22 Eleven Nationally Notable (-A or -B) species were recorded and two species of principal importance: *Hypera meles* (Notable-A), *Agrilus viridis* (Notable-A), *Cryptocephalus bipunctatus* (Notable-B), *Phrurolithus minimus* (Notable-A), *Hygrolycosa rubrofasciata* (Notable-A), *Mangora acalypha* (Notable-B), *Trachyzelotes pedestris* (Notable-B), *Ozyptila simplex* (Notable-B), *Pterostichus longicollis* (Notable-B), *Microplontus campestris* (Notable-B), *Stenocarus ruficornis* (Notable-B), *Tyria jacobaeae* (NERC-S41), and *Allophyes oxyacanthae* (NERC-S41).

### *Summary*

2.4.23 The desk study returned a number of records, principally from the Greatmoor area, comprising: four Nationally Notable or Nationally Scarce species: *Archiearis notha* (NS), *Bembecia ichneumoniformis* (NS), *Commophila aeneana* (NS), and *Agrilus sinuatus* (Notable-A); two notable butterflies defined according to IUCN criteria: *Satyrium pruni* (Endangered) and *Apatura* iris (Near Threatened)); and seventeen species of principal importance: *Adscita statices* (NERC-S41), *Allophyes oxyacanthae* (NERC-S41), *Coenonympha pamphilus* (NERC-S41), *Diarsia rubi* (NERC-S41), *Diloba caeruleocephala* (NERC-S41), *Erynnis tages* (NERC-S41), *Lasiommata megera* (NERC-S41), *Limenitis camilla* (NERC-S41), *Malacosoma neustria* (NERC-S41), *Pyrgus malvae* (NERC-S41), *Scotopteryx chenopodiata* (NERC-S41), *Spilosoma lubricipeda* (NERC-S41), *Spilosoma luteum* (NERC-S41), *Thecla betulae* (NERC-S41), *Timandra comae* (NERC-S41), and *Tyria jacobaeae* (NERC-S41). The broad assemblage associations of these are: arboreal canopy, wood decay, unshaded early successional mosaic, and grassland and scrub matrix; the only specific assemblage types represented are: bark and sapwood decay, and open short sward. Stag beetle is also recorded within 5km.

2.4.24 Three sites were surveyed, all in the vicinity of Greatmoor, with a total of 318 species recorded.

2.4.25 The site with the greatest number of notable species was the Akeman Street disused railway from Grendon Junction to the A41. This disused railway supported a scrub and grassland matrix on its embankments with abundant flowering plants. Nine species of Nationally Notable or Nationally Scarce status as part of the following broad assemblage types were recorded: unshaded early successional mosaic; grassland and scrub matrix; permanent wet mire; mineral marsh and open water; and arboreal canopy. The only specific assemblage types represented are open short sward, and bare sand and chalk. Surveys in 2012 recorded black hairstreak from this site.

2.4.26 The Mega Ditch at Calvert is a long deep cutting with large areas of short sward grassland and bare ground, mixed with taller herbaceous vegetation. At the time of the field survey, the west bank of the cutting was considerably more diverse and botanically rich than the east bank. A wet ditch with a range of emergent plants was in the bottom of the cutting. The site supported two Nationally Notable species, associated with the broad assemblage types of wood decay and unshaded early successional mosaic, and the specific assemblage types of bark and sapwood decay and open short sward respectively.

2.4.27 Finemere Grassland is a semi-improved grassland probably of recent origin. It supported a single Nationally Notable species, assigned to the grassland and scrub matrix broad assemblage type.

## CFA13

### *Notable / Protected Species Recorded*

2.4.28 Twenty four notable species were recorded, comprising 23 Nationally Notable or Nationally Scarce species and one species of principal importance: *Acupalpus exiguus* (Notable-B), *Anaglyptus mysticus* (Notable-B), *Bembidion clarkii* (Notable-B), *Cassida prasina* (Notable-B), *Cryptocephalus aureolus* (Notable-B), *Cryptocephalus bipunctatus* (Notable-B), *Grypus equiseti* (Notable-B), *Ischnomera cyanea* (Notable-B), *Lasius brunneus* (Notable-A), *Longitarsus dorsalis* (Notable-B), *Longitarsus fowleri* (Notable-A), *Longitarsus lycopi* (Notable-B), *Longitarsus nasturtii* (Notable-B), *Magdalis cerasi* (Notable-B), *Platydracus latebricola* (Notable-B), *Polydrusus formosus* (Notable-A), *Psacadina verbekei* (Notable), *Pterostichus anthracinus* (Notable-B), *Ptomaphagus varicornis* (RDBK), *Squamapion cineraceum* (Notable-A), *Tachyporus formosus* (Notable-A), *Temnocerus longiceps* (Notable-B), *Tropistethus holosericeus* (Notable), and *Tyria jacobaeae* (NERC-S41).

### *Summary*

2.4.29 The surveys across the area recorded 607 species. The surveys concentrated on five sites in the vicinity of Calvert complex with one site further north (Barton Hartshorn). The five sites in the Calvert Complex are in close proximity and all are characterised as brownfield, former aggregate extraction sites, or are in close proximity to these. Collectively 24 Nationally Scarce species were recorded with colonies of black hairstreak known to be present from surveys in 2012.

2.4.30 The desk study returned a number of notable records, albeit only from the Calvert area: *Coenonympha pamphilus* (NERC-S41), *Erynnis tages* (NERC-S41), *Lasiommata megera* (NERC-S41), *Limenitis camilla* (NERC-S41), *Pyrgus malvae* (NERC-S41), *Satyrium pruni* (Endangered (IUCN criteria)), *Tyria jacobaeae* (NERC-S41), and *Xestia rhomboidea* (Nationally Scarce).

2.4.31 Within the Calvert complex of sites, Grebe Lake supported the greatest number of notable species, eight in total, comprising seven Nationally Notable species and one species of principal importance. This survey site comprised a fairly extensive area of short sward calcareous grassland on slopes, the result of aggregate extraction, interspersed with some scrub. On flat areas there are areas of impeded drainage forming small pools, probably ephemeral, and wet areas dominated by *Juncus sp*. The lake margins also provided substantial areas of wetland habitat, with a range of emergent plants. The notable species are members of the following broad assemblage types: wood decay, unshaded early successional mosaic and permanent wet mire. The specific assemblage types represented are open short sward, bare sand and chalk, and bark and sapwood decay.

2.4.32 The Calvert Brownfield site is an area of bare and sparsely vegetated ground to the north of the Calvert Lake. The site appears to be capped with clay which was very wet on the first site visit after rain, but dry and cracked on the second after a period of sun. Field surveys recorded six notable species: five Nationally Notable species and one species of principal importance. These species represent the broad assemblage types of arboreal canopy and unshaded early successional mosaic, whilst the specific assemblage types represented are open short sward, and bare sand and chalk.

2.4.33 The Calvert Bank site supported four Nationally Notable species, all of which are members of the broad assemblage type of unshaded early successional mosaic. The site comprises a west-facing bank on the east of the lake, with the vegetation grading from woodland adjoining the railway line (to the east), to open short sward grassland and bare ground near to the lake margin. The grassland was moderately floristically rich with a range of common plants.

2.4.34 The Calvert Rail Station comprises an area of recently felled woodland with large quantities of demolition rubble, among which were areas of ruderal vegetation, varying from short sward to tall herb. Four Nationally Notable species were present, variously members of three broad assemblage types arboreal canopy, wood decay and unshaded early successional mosaic. The specific assemblage types represented are bark and sapwood decay, and open short sward.

2.4.35 Within the accessible parts of the Calvert Landfill, the habitats consisted of a field of damp grassland developed on the site of a disused sports ground; small areas of woodland adjoining this field were also surveyed. Six Nationally Notable species were recorded representing four broad assemblage types, arboreal canopy, unshaded early successional mosaic, wood decay, and mineral marsh and open water. The specific assemblage types represented are bare sand and chalk, heartwood decay, riparian sand and litter rich fluctuating marsh.

2.4.36 The Barton Hartshorn site was physically diverse, including a length of dismantled railway on an embankment, heavily covered with scrub and secondary woodland, a large pond with emergent vegetation and a block of broadleaved plantation woodland. The site supported a species with Red Data Book Insufficiently Known status (RDB K) and three Nationally Notable species. The broad assemblage types represented are wood decay, and mineral marsh and open water, with two species not assigned to assemblage types but rather being known from leaf litter in a range of habitats and also various wetland situations where *Equisetum* is present. The specific assemblage types represented are heartwood decay and riparian sand.

## CFA14

### *Notable / Protected Species Recorded*

2.4.37 Seven notable species were recorded across three sites: *Rhinocyllus conicus* (Notable-A), *Scaphidema metallicum* (Notable-B), *Ischnomera cyanea* (Notable-B), *Pterostichus oblongopunctatus* (Notable-B), *Pipizella virens* (Notable), *Bembidion clarkii* (Notable-B), and *Notaris scirpi* (Notable-B).

### *Summary*

2.4.38 The desk study did not return records of notable species. The field surveys included three sites with a total of 434 species recorded.

2.4.39 The Helmdon Disused Railway SSSI comprised a cutting with embankments of grassland and scrub matrix. Two Nationally Notable species were recorded, associated with the broad assemblage types of unshaded early successional mosaic and wood decay. The specific assemblage type represented was bark and sapwood decay.

2.4.40 The Finmere Quarry comprised a working aggregate extraction site, with large areas of bare and sparsely vegetated ground, together with numerous pools; woodland blocks were also present. Four Nationally Notable species were recorded from the broad assemblage types of grassland and scrub matrix; and mineral marsh and open water. The only specific assemblage type represented was litter and fluctuating marsh.

2.4.41 Halse Coppice comprised a block of semi-natural woodland including areas of wet ground. There were few dead wood habitats and the transition to surrounding arable fields was abrupt. Two Nationally Notable species were recorded, one from the broad assemblage type of wood decay and the specific assemblage type of heartwood decay, and the second from the broad assemblage type of unshaded early successional mosaic.

## CFA15

### *Notable / Protected Species Recorded*

2.4.42 Three notable species were recorded, all of which are Nationally Notable: *Stenus butrintensis* (Notable), *Ischnomera cyanea* (Notable-B), and *Lasius brunneus* (Notable-A).

## 2.5 Summary

2.5.1 Four sites were surveyed, three being mixed farmland sites and one a small semi-natural woodland. No notable records were returned by the desk study.

2.5.2 Manor Farm is a diverse site including a disused railway, small ponds and hedgerows with improved pasture. A single Nationally Notable species was recorded, representing the broad assemblage type of permanent wet mire and the specific assemblage type of reedfen and pools.

2.5.3 Culworth Grounds Farm is a mixed farmland site including a disused hedgerow. A single Nationally Notable species was recorded, representing the broad assemblage type of wood decay and the specific assemblage type of heartwood decay.

2.5.4 Bull's Lane is a mixed farmland site with three areas of damp to wet grassland, and a small stream. No species of conservation concern were recorded.

2.5.5 Fox Covert is a small semi-natural woodland with a fairly large pond. The woodland includes limited areas with an open canopy and supporting a more diverse ground flora. The dead wood habitats are limited in variety and extent.

2.5.6 Two Nationally Scarce species were recorded, both associated with wood decay as the broad assemblage type and heartwood decay as the specific assemblage type.

# 3 Aquatic invertebrates

## 3.1 Introduction

3.1.1 This section of the appendix presents details of baseline information relating to aquatic invertebrates (from river water bodies) that is relevant to the section of the Proposed Scheme that will pass through CFA7 to 11 inclusive. Aquatic invertebrate data for lake water bodies is included in a separate Vol. 5 appendix EC-001-002.

## 3.2 Methodology

3.2.1 Details of the standard methodology utilised for aquatic invertebrate survey are provided in Technical Note HS2 Ecological Surveys: Field Survey Methods and Standards which is included as an appendix to Volume 1. Macroinvertebrate surveys were co-ordinated to match up with fishery surveys.

3.2.2 Desk study records relating to aquatic invertebrates were obtained from the Environment Agency (EA).

3.2.3 A summary of locations at which aquatic invertebrate surveys were undertaken within the section of the Proposed Scheme that will pass through CFA7 to 15 inclusive is provided in Table 4.

Table 4: Summary of aquatic invertebrate survey locations for CFA7 to 15 inclusive

| Ecology survey code | Watercourse | Feature type | Survey date(s) | CFA | Approximate distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|
| 020_IA1_027006 | River Colne - Downstream | Main river | 14 May 2013 | 7 | 30m north |
| 020_IA1_027007 | River Colne - Crossing Point | Main River | 14 May 2013 | 7 | Within the Proposed Scheme |
| 020_IA1_027008 | River Colne - Upstream | Main River | 13 May 2013 | 7 | 120m north |
| 020_IA1_036001 | River Misbourne | Main River | 30 May 2013 | 8 | 123m north |
| 020_IA1_041001 | River Misbourne | Main River | 30 May 2013 | 8 | 123m west |
| 020_IA1_053001 | Castle Park Stream | Stream | 29 April 2013 | 10 | 273m west |
| 020_IA1_056001 | Unknown Tributary of Stoke Brook | Tributary of Main River | 23 May 2013 | 10 | 110m north |
| 020_IA1_057001 | Stoke Brook | Main River | 20 May 2013 | 11 | Within the Proposed Scheme |
| 020_IA1_057002 | Stoke Brook | Main River | 20 May 2013 | 11 | Within the Proposed Scheme |
| 020_IA1_058001 | Stoke Brook | Main River | 29 April 2013 | 11 | Within the Proposed Scheme |
| 020_IA1_061001 | Sedrup Ditch | Ditch | 21 May 2013 | 11 | Within the Proposed Scheme |
| 020_IA1_063001 | Lower Hartwell Ditch | Ditch | 21 May 2013 | 11 | Within the Proposed Scheme |
| 020_IA1_064001 | River Thame | Main River | 4 June 2013 | 11 | 58m north |
| 020_IA1_064002 | River Thame | Main River | 4 June 2013 | 11 | 49m west |
| 020_IA1_065001 | Fleet Marston Brook | Stream/Ditch | 24 May 2013 | 11 | 26m north |
| 020_IA1_070001 | Marston Brook | Stream/Ditch | 30 April 2013 | 12 | Within the Proposed Scheme |
| 020_IA1_074001 | River Ray | Main River | 22 May 2013 | 12 | 132m east |
| 020_IA1_076001 | Muxwell Brook | Stream/Ditch | 2 May 2013 | 12 | Within the Proposed Scheme |
| 020_IA1_076003 | Muxwell Brook | Stream/Ditch | 2 May 2013 | 12 | 7m west |
| 020_IA1_081001 | Tributary of Padbury Brook (Padbury Ditch?) | Tributary of Main River | 22 May 2013 | 13 | Within the Proposed Scheme |
| 020_IA1_082001 | Padbury Brook | Main River | 22 May 2013 | 13 | 43m west |
| 020_IA1_083001 | Padbury Brook (Tributary) | Tributary of Main River | 13 June 2013 | 13 | 30m north |
| 020_IA1_083002 | Padbury Brook (Tributary) | Tributary of Main River | 13 June 2013 | 13 | 90m north |
| 020_IA1_092001 | River Great Ouse | Main River | 28 May 2013 | 14 | 1m north-east |
| 020_IA1_095001 | River Great Ouse | Main River | 23 May 2013 | 14 | 1m north |
| 020_IA1_099001 | River Great Ouse & Backwaters | Main River | 6 June 2013 | 14 | 16m east |
| 020_IA1_101001 | Tributary of the River Ouse | Tributary of | 29 May 2013 | 15 | 183m north-east |

| Ecology survey code | Watercourse | Feature type | Survey date(s) | CFA | Approximate distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|
| | | main river | | | |
| 020_IA1_104001 | Lower Thorpe Brook (a Tributary of the River Cherwell) | Tributary of Main River | 28 May 2013 | 15 | Within the Proposed Scheme |
| 020_IA1_112002 | Highfurlong Brook | Stream | 30 May 2013 | 15 | 1 south-east |
| 020_IA1_114001 | Boddington canal feeder | Stream/Ditch | 5 June 2013 | 15 | 17 south |

## 3.3 Deviations, constraints and limitations

3.3.1 Macroinvertebrate summaries are based on one-season spring data - no comparison can be made between observed and expected scores without two-season RICT/RIVPACS analysis. Seasonal variation in the macro-invertebrate community cannot be assessed. Where surveys were carried out in autumn 2012, locations were limited and seasonal variation has not been assessed. Details of sites where access was not available are listed in Table 5.

Table 5: Summary of locations in CFA7 to 15 inclusive where the requirements for aquatic invertebrate survey was identified but which were not accessible for survey

| Site and location | OS centroid grid reference | Description of proposed survey location | CFA | Approximate distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|
| Grand Union Canal, Harefield | TQ055878 | Artificial/modified water body, may contain important invertebrate populations | 7 | Within the Proposed Scheme |
| Wendover Brook | SP862090 | Small groundwater fed water body, documented source within 350m of proposed route | 10 | Within the Proposed Scheme |
| Padbury Brook, Twyford | SP665270 | One of two crossing points on the Padbury Brook | 13 | Within the Proposed Scheme |
| Lower Thorpe Brook (a Tributary of the River Cherwell) | SP518478 | Small tributary of River Cherwell, only a small section could be observed, with moderate fish habitat | 15 | Within the Proposed Scheme |
| River Cherwell, Tributary Bridge | SP517479 | River Cherwell, main river. Surveys proposed at crossing point and downstream of crossing point. | 15 | Within the Proposed Scheme |
| Lower Thorpe Brook (a Tributary of the River Cherwell) | SP514483 | Small tributary of River Cherwell, only a small section could be observed | 15 | Within the Proposed Scheme |

3.3.2 Eight water bodies could not be surveyed due to limited access. These water bodies are detailed below. Additional catchment-wide monitoring of the River Misbourne was planned but the limited access meant this wasn't possible in full. Two location points were surveyed in total and data from Shardeloes Lake was also obtained. Where possible Environment Agency data has been used to augment more recent data collection.

**CFA7**

3.3.3 Grand Union Canal (km marker 026). No landowner approval for access.

**CFA10**

3.3.4 Wendover Brook (km marker 054). No landowner approval for access.

**CFA13**

3.3.5 Padbury Brook (km marker 082). No landowner approval for access, although a survey took place at an upstream crossing point on the same water body.

3.3.6 Padbury Brook tributary (km marker 087). No landowner approval for access.

**CFA15**

3.3.7 River Cherwell and two small un-named tributaries (km marker 108). No landowner approval for access.

## 3.4 Baseline

### CFA 7

*River Colne*

**Existing EA data**

3.4.1 The data for the existing EA River Colne site at Moorfield Road, Harefield (less than 100m from crossing point), indicates that there is generally a good diversity of macroinvertebrate taxa present, with fairly high numbers of taxa found in each sample. The BMWP[3] scores indicate consistently 'Fair' to 'Good' water quality and ASPT[4] scores indicate 'Good' to 'Very Good' water quality. The regular presence of pollution sensitive mayflies (Ephemeridae and Ephemerellidae) and pollution sensitive caddisflies (Leptoceridae), sometimes in high numbers, also suggests 'Good' water quality.

3.4.2 The high LIFE[5] scores and regular presence of rheophilic (moderate / fast flow) taxa including riffle beetle (Elmidae), the caddisflies Leptoceridae and the mayflies

[3] The Biological Monitoring Working Party (BMWP) Score is an index for measuring the biological quality of rivers using species of macroinvertebrates as biological indicators.
[4] The Average Score Per Taxon (ASPT) is worked out by dividing the BMWP score by the number of families found. This score is between 0 and 10.

[5] Lotic-invertebrate Index for Flow Evaluation (LIFE) is a method for linking benthic macro-invertebrate data to prevailing flow regimes.

Ephemeridae and Ephemerellidae suggests reasonable flows. LIFE scores remained good during the drought period (2004 – 2005).

### HS2 Data

3.4.3 Data from 2012 for the Colne Valley recorded a low number of taxa with limited conservation interest. Only two taxa were present in numbers, the crustacean *Crangonyx pseudogracilis* and a variety of larvae of Chironomidae midges.

*River Colne – Downstream (020-IA1-027001)*

3.4.4 The PSI score indicates that the river bed condition is 'Moderately sedimented' and that the ecology is impacted by fine sediment. There is a moderate CCI score due to the presence of two species of 'Local' conservation interest (the leech *Trocheta bykowskii* and the snail *Bithynia leachii*). These 'Local' species may be widely distributed in the UK but are not considered 'common'. The moderate CCI score indicates that the community may be considered to enrich the local stretch of the river.

3.4.5 There is a moderate diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Fair' water quality. Freshwater shrimp, riffle beetles, mayfly and a variety of caddisfly larvae are present. Some families that are highly sensitive to organic pollution (Ephemeridae and Leptoceridae) are found here. LIFE scores are high due to the presence of rheophilic (fast flow) taxa.

*River Colne - Crossing Point (020-IA1-028001)*

3.4.6 The PSI score indicates that the river bed condition is 'Heavily sedimented' and that the ecology is impacted by fine sediment. There is a low to moderate CCI score due to taxa being dominated by 'Very Common' species and a single species of 'Local' Conservation interest (*Bithynia leachii*). These 'very common' species may be widely distributed in the UK but are not considered 'Common'. The moderate CCI score indicates that the community may be considered to enrich the local stretch of the river.

3.4.7 There is a moderate diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Fair' water quality. Freshwater shrimp, mayfly, riffle beetle, water boatman and caddisfly larvae are present. There are no taxa present that are highly sensitive to organic pollution.

*River Colne - Upstream (020-IA1-028005)*

3.4.8 The PSI score indicates that at this site the river bed condition is 'Moderately sedimented' and that the ecology is impacted by fine sediment. There is a moderate CCI score due to the presence of two species of 'Local' conservation interest (the leech *Trocheta bykowskii* and the snail *Bithynia Leachii*). These 'Local' species are widely distributed in the UK but are not considered 'Common'. The moderate CCI score indicates that the community may be considered to enrich the local stretch of river.

3.4.9 There is a moderate diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Poor' to 'Fair' water quality. Freshwater shrimp, mayfly, riffle beetle, and a

variety of caddisfly larvae are present. There are several families recorded that are highly sensitive to organic pollution, including Leptoceridae, Rhyacophilidae and Lepidostomatidae. LIFE scores are high due to the presence of these rheophilic (fast flow) taxa.

### *River Misbourne*

#### Existing EA data

3.4.10 The existing data for the River Misbourne, downstream of Gerrards Cross Sewage Treatments Works (STW) (less than 2.5km from the land required for the construction of the Proposed Scheme), indicates that all biological indices at this site are quite variable, suggesting intermittent stress. BMWP scores range from 'Poor' to 'Good' water quality, with most samples indicating 'Fair' quality. ASPT scores range widely from 'Poor' to 'Good', with most samples indicating 'Good' water quality. The Misbourne does not dry out here in times of drought as base flow is maintained by the outflow from the STW. The impact of drought on the macroinvertebrate is not, therefore, as great here as it is at some of the other Misbourne sites. However, all the water quality indices are likely to be influenced by the effects of low flows during drought.

3.4.11 LIFE scores were at their lowest during and immediately after the 2004 / 2005 drought period. In more recent years they have improved and remained quite stable. This indicates that drought is impacting the flow sensitive ecology but at times of prolonged good flow the community is able to stabilise.

3.4.12 At the Misbourne site below Denham Village there is a very good diversity of macroinvertebrate taxa present. The Misbourne is not known to dry out in this location, even in times of drought. BMWP scores are high and range from 'Fair' to 'Very Good' water quality, with most samples indicating good water quality. ASPT scores are also high and quite evenly split between good and very good water quality. Number of taxa also varies but never drops as low as it does at those Misbourne sites that are known to dry out. The biological indices are generally higher and more stable at this site and do not drop as low as they do at those Misbourne sites that dry out. The impact of drought on macroinvertebrates is not, therefore, as great here as it is at some of the other Misbourne sites. There is a general trend of a declining number of taxa since 2002. All the water quality indices are, however, likely to be influenced by the effects of low flow.

3.4.13 LIFE scores do not show any clear drop following the 2004 and 2005 drought, suggesting that the site is not as impacted by low flows as some of the other sites on the Misbourne.

#### HS2 Data

3.4.14 No macroinvertebrate samples were collected for the section of the River Misbourne within this CFA for this water body due to access issues.

## CFA8

### *River Misbourne*

#### Existing EA data

3.4.15 The biological indices for the River Misbourne sites above Old Amersham and Bottom House Farm Lane (both less than 100m from crossing point) are very variable, suggesting intermittent stress. The Misbourne in this area is known to dry out for prolonged periods, particularly in times of drought, leaving periods of no data where it is likely the channel was dry. LIFE scores do not vary greatly at either site but should also be treated with caution at sites that are known to dry out.

3.4.16 BMWP scores for both sites range from 'Poor' to 'Good' water quality, with most samples indicating 'Fair' quality. ASPT scores again range widely from 'Poor' to 'Very Good', with most samples indicating 'Fair' to 'Good' water quality. Number of taxa drop very low at times, this is probably due to the site drying out and being re-colonised by taxa that can colonise quickly and tolerate dry periods. However, these indices are all likely to be influenced by the effects of drought.

3.4.17 The existing data for the Misbourne at Little Missenden (less than 1km from land required for the construction of the Proposed Scheme) shows that all the biological indices at this site are very variable, suggesting intermittent stress. This site is also known to dry out in times of drought. BMWP scores range from 'Poor' to 'Good' water quality, with most samples indicating fair quality. ASPT scores again range widely from poor to very good, with most samples indicating 'Fair' water quality. It is likely that the water quality indices are influenced by the effects of drought and do not reflect the actual quality of the water at this site.

3.4.18 LIFE scores are variable at this site and dip quite low at times, suggesting that flow sensitive ecology is being impacted. LIFE scores should be treated with caution at sites that are known to dry out.

3.4.19 The macroinvertebrate diversity in the River Misbourne site at the Community Centre, Chalfont St Peter (within 1km of the Proposed Scheme, is fairly limited. All biological indices at this site are low for this river, suggesting the site is under stress. The Misbourne in this area is known to dry out regularly. BMWP scores are low and range from 'Very Poor' to 'Fair' water quality, with most samples indicating 'Fair' quality. ASPT scores are again low, ranging widely from 'Poor' to 'Good', with most samples indicating 'Poor' water quality. The numbers of taxa are also very low suggesting that the macroinvertebrate community is never able to recover from drying out. It is likely that the biological indices are low due to the effects of drought and do not reflect the actual quality of the water at this site.

3.4.20 LIFE scores are also low at this site, supporting the statement that ecology is being impacted by flow. LIFE scores should be treated with caution at sites that are known to dry out.

### HS2 Data

*2012 Data*

3.4.21 2012 data from Shardeloes Lake recorded a low number of taxa with limited conservation interest.

*River Misbourne (020-IA1-036001)*

3.4.22 The PSI score indicates that the river bed condition is 'Sedimented' and that the ecology is impacted by fine sediment. There is a very low CCI score due to low diversity and all species being of 'Very Common' to 'Frequent' occurrence.

3.4.23 There is a low diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Poor' water quality. The macroinvertebrate assemblage was dominated by snails, flatworms, leeches, fly larvae and freshwater shrimp. There were no taxa recorded that are notably sensitive to organic pollution.

*River Misbourne (020-IA1-041001)*

3.4.24 The PSI score indicates that the river bed condition is 'Heavily Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to low taxa diversity and all species are 'Very Common' to 'Common' (occurring in 25-50% of similar samples). The low CCI score indicates that the conservation importance is 'Low'.

3.4.25 There is a low diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Fair' water quality. Freshwater shrimp, mayfly, and a variety of caddisfly larvae are present. Several families that are highly sensitive to organic pollution are found here, including Ephemeridae and Leptoceridae.

## CFA9

### *Existing EA data*

3.4.26 No existing Environment Agency data was available for this CFA.

### *HS2 Data*

3.4.27 No macroinvertebrate samples were collected within this CFA as no suitable sites were identified.

## CFA10

### *Existing EA data*

3.4.28 No existing Environment Agency data was available for this CFA.

### *HS2 Data*

#### Castle Park Stream

*Castle Park Stream (020_IA1_053001)*

3.4.29 The PSI score for this site indicates that it is 'Moderately Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to very low taxa diversity and all species have a 'Very Common' (50-100% of similar samples) to

'occasional' (up to 10% of similar samples) occurrence. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.30 There is a very low diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Poor' water quality. Freshwater shrimp and caddisfly larvae are present. There are no families present that are highly sensitive to organic pollution.

#### Tributary of Stoke Brook

*Tributary of Stoke Brook (020_IA1_056001)*

3.4.31 The PSI score for this site indicates that it is 'Moderately Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to moderate diversity and all species 'very common' (50-100% of similar samples) to 'frequent' (10-25% of similar samples) occurrence.

3.4.32 There is a moderate diversity of macroinvertebrate taxa present. The BMWP/ASPT scores indicate 'Fair' water quality. Freshwater shrimp, riffle beetle, mayfly and a variety of caddisfly larvae are present. There are no families present that are highly sensitive to organic pollution.

## CFA11

### *Existing EA data*

3.4.33 No existing Environment Agency data was available for this CFA.

### *HS2 Data*

3.4.34 2012 data recorded a moderate number of taxa at the River Thame. The nationally scarce water beetle *Peltodytes caesus* was present in this watercourse.

#### Stoke Brook

*Stoke Brook (020-IA1-057001)*

3.4.35 The PSI score indicates that the river bed condition is 'Moderately Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to low diversity and all species have a 'Very Common' (50-100% of similar samples) to 'frequent' (10-25% of similar samples) occurrence. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.36 There is a low diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Poor' water quality. Freshwater shrimp, mayfly, riffle beetle, and a variety of caddisfly larvae are present. No families are present that are highly sensitive to organic pollution.

*Stoke Brook (020-IA1-057002)*

3.4.37 The PSI score indicates that the river bed condition is 'Moderately Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to low diversity and all species are of 'Very Common' (50-100% of similar samples) to 'frequent' (10-25% of similar samples) occurrence. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.38 There is a moderate diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Poor' to 'Fair' water quality. Freshwater shrimp, mayfly, riffle beetle, and a variety of caddisfly larvae are present. No families are found that are highly sensitive to organic pollution.

*Stoke Brook (020_IA_058001)*

3.4.39 The PSI score indicates that the river bed is 'Slightly Sedimented' and that the ecology is slightly impacted by fine sediment. There is a low CCI score due to low diversity and all species are of 'Very Common' (50-100% of similar samples) to 'occasional' (up to 10% of similar samples) occurrence. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.40 There is a low diversity of macroinvertebrate taxa present. The BMWP/ASPT scores indicate that there is 'Fair' water quality. Freshwater shrimp, riffle beetle, mayfly and caddisfly larvae are present. There is one family present that is highly sensitive to organic pollution (Rhyacophilidae).

### Sedrup Ditch

*Sedrup Ditch (020_IA1_061001)*

3.4.41 The PSI score indicates that the ditch bed is 'Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to low diversity and occurrence of all species varies from 'Very Common' (50-100% of similar samples) to 'Common' (occurs in 25-50% of similar samples). The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.42 There is a low diversity of macroinvertebrate taxa present. The BMWP/ASPT scores indicate that there is 'Fair' water quality. Freshwater shrimp, riffle beetle and caddisfly larvae are present. There are no families present that are highly sensitive to organic pollution.

### Hartwell Ditch

*Hartwell Ditch (020-IA1-063001)*

3.4.43 The PSI score indicates that the river bed condition is 'Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to moderate diversity and all species are of 'Very Common' (50-100% of similar samples) to 'frequent' (10-25% of similar samples) occurrence.

3.4.44 There is a moderate diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Poor' to 'Fair' water quality. Freshwater shrimp, riffle beetle, and a variety of caddisfly larvae are present. No families are found that are highly sensitive to organic pollution.

### River Thame

*River Thame (020-IA1-064001)*

3.4.45 The PSI score indicates that the river bed condition is 'Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to low diversity and

all species are of 'Very Common' (50-100% of similar samples) to 'frequent' (10-25% of similar samples) occurrence. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.46 There is a moderate diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Poor' to 'Fair' water quality. There is a broad variety of taxa present including water beetles, mayfly larvae, caddisfly larvae and freshwater shrimp. No families are present that are highly sensitive to organic pollution.

*River Thame (020-IA1-064002)*

3.4.47 The PSI score indicates that the river bed condition is 'Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to low diversity and all species are of 'Very Common' (50-100% of similar samples) to 'Occasional' (up to 10% of similar samples) occurrence. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.48 There is a low to moderate diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Fair' water quality. Freshwater shrimp, mayfly, damselfly, and a variety of caddisfly larvae are present. No families are present that are highly sensitive to organic pollution.

**Fleet Marston Brook**

*Fleet Marston Brook (020_IA1_065001)*

3.4.49 The PSI score indicates that the river bed condition is 'Heavily Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to moderate diversity and all species are of 'Very Common' (50-100% of similar samples) to 'frequent' (10-25% of similar samples) occurrence. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.50 There is a moderate diversity of macroinvertebrate taxa present. The BMWP/ASPT scores indicate that there is 'Poor' to 'Fair' water quality. There are freshwater shrimp, water beetle and caddisfly larvae present. There are no families present that are highly sensitive to organic pollution.

## CFA 12

### *Existing EA data*

3.4.51 No existing Environment Agency data was available for this CFA

### *HS2 Data*

**Marston Brook**

*Marston Brook (020_IA1_070001)*

3.4.52 The PSI score indicates that the river bed condition is ' heavily sedimented' and that the ecology is impacted by fine sediment. There is a moderate CCI score due to generally low diversity of taxa and the presence of a single snail of 'Local' conservation interest, *Anisus leucostoma*. These 'Local' species may be widely distributed in the UK

but not considered 'common'. The moderate CCI score indicates that the community is considered to enrich the local area.

3.4.53 There is a very low diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Poor' to 'Very Poor' water quality. The macroinvertebrate community was dominated by organic pollution-tolerant worms, snails, leeches and midge larvae. Notably, there were no freshwater shrimp present.

### River Ray

*River Ray (020_IA1_074001)*

3.4.54 The PSI score indicates that the river bed condition is ' Heavily Sedimented' and that the ecology is impacted by fine sediment. There is a very low CCI score due to low taxa diversity and all species are 'Very Common' to 'Ccommon' (occurs in 25-50% of similar samples). The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.55 There is a low diversity of macroinvertebrate taxa present. BMWP score indicates 'Poor' water quality but ASPT indicates 'Good' water quality. This is due to the low diversity of taxa and the absence of pollution-tolerant taxa. The macroinvertebrate community was dominated by species that are moderately sensitive to organic pollution, including freshwater shrimp, mayfly larvae and stonefly larvae.

### Muxwell Brook

*Muxwell Brook (020-IA1-076001)*

3.4.56 The PSI score indicates that the bed of the brook is ' Heavily Sedimented' and that the ecology is impacted by fine sediment. There is a moderate to high CCI score due to the presence of two 'Notable' beetle species; *Agabus melanarius* and *Enochrus affinis*, (Not RDB 1-3, but occur in fewer than a hundred 10km squares of the UK National Grid). The moderate CCI score indicates that the community is considered to enrich the local stretch of river.

3.4.57 There is a moderate diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Fair' water quality. Freshwater shrimp, stonefly nymph, riffle beetle, and a variety of caddisfly larvae are present. Several families that are highly sensitive to organic pollution are found here, including Leptoceridae, Ephemeridae, and Ephemerellidae.

*Muxwell Brook (020-IA1-076003)*

3.4.58 The PSI score indicates that the river bed condition is 'Heavily Sedimented' and the ecology is impacted by fine sediment. There is a low CCI score due to very low diversity and all species are of 'Very Common' (50-100% of similar samples) to 'occasional' (up to 10% of similar samples) occurrence. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.59 There is very low diversity of macroinvertebrate taxa present. The BMWP/ASPT scores indicate that there is 'Poor' water quality. Freshwater shrimp, stonefly and

caddisfly larvae are present. There are no families present that are highly sensitive to organic pollution.

## CFA13

### *Existing EA data*

3.4.60 No existing Environment Agency data was available for this CFA.

### *HS2 Data*

#### 2012 Data

3.4.61 2012 data from Calvert Jubilee LWS recorded a low number of taxa, with species typical of open water and reed beds.

#### Unknown Tributary of Padbury Brook

*Unknown Tributary of Padbury Brook (020_IA1_081001)*

3.4.62 The PSI score indicates that the river bed condition is ' Heavily Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to low taxa diversity and all species are 'Very Common' to 'Common' (occurs in 25-50% of similar samples). The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.63 There is a moderate diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Poor' to 'Fair' water quality. The presence of scavenger beetles and true-bugs (backswimmer, pond-skater) indicates slow flow velocity.

#### Padbury Brook

*Padbury Brook (020-IA1-082001)*

3.4.64 The PSI score indicates that the river bed condition is 'Sedimented' and that the ecology is impacted by fine sediment. There is a moderate CCI score due to presence of one species of 'Local' conservation interest (the caddisfly *Polycentropus kingii*). These 'Local' species are widely distributed in the UK but are not considered 'Common'. The moderate CCI score indicates that the community is considered to enrich the local area.

3.4.65 There is a low diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Fair' to 'Good' water quality. Freshwater shrimp, mayfly, and caddisfly larvae are present. Several families that are highly sensitive to organic pollution are found here, including Ephemeridae, Ephemerellidae and Leptophlebiidae.

*Padbury Brook (Trib) (020_IA1_083001)*

3.4.66 The PSI score indicates that the river bed condition is 'Heavily Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to moderate diversity and all species are of 'Very Common' (50-100% of similar samples) to 'frequent' (10-25% of similar samples) occurrence. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.67 There is a moderate diversity of macroinvertebrate taxa present. The BMWP/ASPT scores indicate that there is 'Fair' water quality. Freshwater shrimp, water beetles, mayfly, damselfly and a variety of caddisfly larvae are present. There is one family present that is highly sensitive to organic pollution (Ephemeridae).

*Padbury Brook (Trib) (020-IA1-083002)*

3.4.68 The PSI score indicates that the river bed condition is ' Moderately Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to low diversity and all species are of 'Very common' (50-100% of similar samples) occurrence. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.69 There is a low diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Fair' to 'Good' water quality. Freshwater shrimp, mayfly, and caddisfly larvae are present. Several families that are highly sensitive to organic pollution are found here, including Ephemeridae, Ephemerellidae and Leptoceridae.

## CFA14

### *Existing EA data*

3.4.70 No Environment Agency data was available for water bodies within this CFA

### *HS2 Data*

**River Great Ouse**

*River Great Ouse (020-IA1-092001)*

3.4.71 The PSI score indicates that the river bed condition is 'Sedimented' and that the ecology is impacted by fine sediment. There is a low to moderate CCI score due to moderate taxa diversity, and all species are of 'Very Common' (50-100% of similar samples) to 'occasional' (up to 10% of similar samples) occurrence. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.72 There is a moderate diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Good' water quality. There is a broad variety of taxa present including water beetles, mayfly larvae, caddisfly larvae and freshwater shrimp. Several families that are highly sensitive to organic pollution are found here, including Leptoceridae, Ephemeridae, and Ephemerellidae. LIFE scores are high due to the presence of these rheophilic (fast flow) taxa.

*River Great Ouse (020_IA1_095001)*

3.4.73 The PSI score indicates that the river bed condition is ' Moderately Sedimented' and that the ecology is impacted by fine sediment. There is a moderate CCI score due to presence of one species of 'Local' conservation interest (the caddisfly *Polycentropus kingii*). The species may be widely distributed in the UK but not considered 'common'.

3.4.74 There is a moderate to high diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Good' to 'Very Good' water quality. A broad variety of taxa are present including water beetles, mayfly larvae, caddisfly larvae and freshwater shrimp. There

are several families present that are highly sensitive to organic pollution, including Leptoceridae, Ephemeridae, Ephemerellidae, Rhyacophilidae & Leptophlebiidae. High LIFE scores are high due to the presence of these rheophilic (fast flow) taxa.

*River Great Ouse and Backwaters (020_IA1_099001)*

3.4.75 The PSI score indicates that the river bed condition is 'Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to low diversity with most species being of 'Very Common' (50-100% of similar samples) to 'Common' (occurs in 25-50% of similar samples). The locally important alderfly larvae *Sialis fuliginosa* is present. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.76 There is a low diversity of macroinvertebrate taxa present. The BMWP/ASPT scores indicate 'Fair' to 'Good' water quality. Freshwater shrimp, mayfly, stonefly, water beetle and a variety of caddisfly larvae are present. There are two families present that are highly sensitive to organic pollution (Sericostomatidae & Leptophlebidae).

## CFA15

### *River Cherwell*

#### Existing EA Data

3.4.77 The existing macroinvertebrate data for Cherwell, Trafford Bridge shows a decline in BMWP from 'Very Good' quality in 2002 to 'Poor' quality in 2008. The number of taxa also decline dramatically from 25 in 2002 to six in November 2008. The likely cause of the decline is the presence of high numbers of invasive signal crayfish. The macroinvertebrate sample data only shows one signal crayfish found in April 2003 and one in November 2008. However, it is likely that standard macroinvertebrate sampling methods under record signal crayfish and, therefore, it is still possible that there are high numbers present at this site. ASPT and LIFE scores follow a different trend and have been seen to steadily increase since 2002 until they dropped significantly in November 2008, again probably reflecting the impact of signal crayfish on the macroinvertebrate community. Signal crayfish predate on the slower, lower scoring invertebrates, which can elevate ASPT and LIFE scores.

3.4.78 Species data is available for this site and there are some taxa present that are of particular conservation interest. There are two species of 'Local' conservation interest that have been recorded at this site (*Beraeodes minutus* – found in April 2002 and *Calopteryx virgo* – found in April 2002, October 2002 and November 2007). These species are widely distributed in the UK but are not considered 'Common'. There is one 'Regionally Notable' species recorded here (*Brachycentrus subnubilus* – found in October 2002). Regionally Notable refers to taxa that are too common nationally to fall within the Notable category but which are uncommon in some parts of the country. There is also one 'Rare' (Red Data Book 3) species recorded at this site (*Pisidium tenuilineatum*) – found in November 2007.

### *Highfurlong Brook*

#### HS2 Data

3.4.79 The site on the Highfurlong Brook, above Aston Le Walls (less than 2km from crossing point), has an excellent diversity of macroinvertebrate taxa present. The BMWP and ASPT scores both indicate very good water quality. The presence of pollution sensitive mayflies (Ephemeridae, Heptageniidae and Leptophlebiidae), pollution sensitive caddisflies (Goeridae, Brachycentridae, Lepidostomatidae, Leptoceridae, Sericostomatidae) and the pollution sensitive stonefly Perlodidae, are also indicative of 'Good' water quality.

3.4.80 The LIFE score is high at this site and the presence of rheophilic (rapid and moderate / fast flow) taxa including the beetle Elmidae, the caddisflies Rhyacophilidae and Goeridae, the stonefly Perlodidae and the mayflies Ephemeridae, Heptageniidae and Leptophlebiidae suggests reasonable flows.

### *Lower Thorpe Brook (a Tributary of the River Cherwell)*

#### Existing EA Data

3.4.81 Existing data for Lower Thorpe Brook (a Tributary of the River Cherwell) (1.5km downstream of a crossing point) show there is a moderate diversity of macroinvertebrate taxa present. The BMWP score indicates fair water quality and the ASPT score indicates 'Good' water quality. The presence of pollution sensitive mayflies (Ephemeridae and Leptophlebiidae) and the pollution sensitive caddisflies (Goeridae) also suggests 'Good' water quality. The LIFE score is high at this site and the presence of rheophilic (moderate / fast flow) taxa including the beetles Elmidae, the caddisflies Rhyacophilidae and Goeridae and the mayflies Ephemeridae and Leptophlebiidae suggests reasonable flows.

#### HS2 Data

*Lower Thorpe Brook (a Tributary of the River Cherwell)*

*(020_IA1_104001)*

3.4.82 The PSI score indicates that the river bed condition is 'Moderately Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to low diversity. All species are of 'Very Common' (50-100% of similar samples) to 'Frequent' (10-25% of similar samples) in occurrence. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.83 There is a low diversity of macroinvertebrate taxa present. The BMWP/ASPT scores indicate 'Poor' to 'Fair' water quality. Freshwater shrimp, mayfly and caddisfly larvae are present. There are no families present that are highly sensitive to organic pollution

### *Tributary of River Ouse*

**HS2 Data**

*Tributary of the River Ouse (020-IA1-101001)*

3.4.84 The PSI score indicates that the river bed condition is 'Sedimented' and that the ecology is impacted by fine sediment. There is a low CCI score due to low diversity and all species are of 'Very Common' (50-100% of similar samples) to 'Frequent' (10-25% of similar samples) occurrence. The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.85 There is a low diversity of macroinvertebrate taxa present. BMWP/ASPT scores indicate 'Poor' water quality. The macroinvertebrate community was dominated by snails, flatworms, leeches, fly larvae and freshwater shrimp. No taxa that are highly sensitive to organic pollution are present.

### *Highfurlong Brook*

*Highfurlong Brook (020_IA1_112002)*

3.4.86 The PSI score indicates that the river bed condition is 'sedimented' and that the ecology is impacted by fine sediment. There is a very low CCI score due to low taxa diversity and all species are 'Very Common' (occurs in 50-100% of similar samples). The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.87 There is a low diversity of macroinvertebrate taxa present. The BMWP/ASPT scores indicate 'Poor' water quality. Freshwater shrimp, mayfly and caddisfly larvae are present. There are no families present that are highly sensitive to organic pollution.

### *Boddington canal feeder*

*Boddington canal feeder (020_IA1_114001)*

3.4.88 The PSI score indicates that the river bed condition is 'Heavily Sedimented' and the ecology is impacted by fine sediment. There is a low to moderate CCI score due to presence of a single 'Notable' beetle species *Haliplus laminatus* (not in RDB categories 1-3 but scarce in Great Britain). The low CCI score indicates that the conservation importance of the community is 'Low'.

3.4.89 There is a low diversity of macroinvertebrate taxa present. The BMWP/ASPT scores indicate 'Poor' to 'Fair' water quality. Freshwater shrimp, water beetle, damselfly and caddisfly larvae are present. There are no families present that are highly sensitive to organic pollution.

Table 6: Summary of biotic indices calculated for aquatic invertebrate survey locations, for CFA7 to 15 inclusive

| Ecology survey code | Watercourse | CFA | Total Number of Taxa in Sample | Total Abundance in Sample | BMWP Score | ASPT | N-Taxa | LIFE Score (Family) | LIFE Score (Species) | CCI Score | PSI | PSI Interpretation | Notable Taxa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 020_lA1_027001 | River Colne - Downstream | 7 | 26 | 1,542 | 67 | 4.19 | 16 | 7.29 | 8.14 | 9.25 | 43.48 | Moderately sedimented | The leech Trocheta bykowskii and the snail Bithynia Leachii are both of 'Local' conservation interest |
| 020_lA1_027002 | River Colne - Crossing Point | 7 | 19 | 1,423 | 68 | 4.25 | 16 | 5.40 | 6.43 | 6.79 | 16.13 | Heavily sedimented | A single species of 'Local' conservation interest (*Bityhnia leachii*) |
| 020_lA1_027003 | River Colne - Upstream | 7 | 26 | 1,247 | 70 | 3.89 | 18 | 6.94 | 7.45 | 8.81 | 41.18 | Moderately sedimented | 2 species of 'Local' conservation interest (the leech *Trocheta bykowskii* and the snail *Bithynia Leachii*) |
| 020_lA1_036001 | River Misbourne | 8 | 17 | 870 | 49 | 3.77 | 13 | 6.45 | 6.60 | 1.22 | 27.27 | Sedimented | No notable taxa present |
| 020_lA1_041001 | River Misbourne | 8 | 13 | 1,185 | 63 | 4.85 | 13 | 6.18 | 6.67 | 3.38 | 13.79 | Heavily sedimented | No notable taxa present |
| 020_lA1_053001 | Castle Park Stream | 10 | 8 | 782 | 34 | 4.25 | 8 | 7.00 | 7.33 | 4.50 | 50.00 | Moderately sedimented | No notable taxa present |
| 020_lA1_056001 | Unknown Tributary of Stoke Brook | 10 | 17 | 4,695 | 72 | 4.50 | 16 | 7.23 | 8.45 | 4.50 | 60.00 | Moderately sedimented | No notable taxa present |
| 020_lA1_057001 | Stoke Brook | 11 | 19 | 1,127 | 49 | 3.77 | 13 | 6.91 | 7.31 | 3.67 | 40.63 | Moderately sedimented | No notable taxa present |

| Ecology survey code | Watercourse | CFA | Total Number of Taxa in Sample | Total Abundance in Sample | BMWP Score | ASPT | N-Taxa | LIFE Score (Family) | LIFE Score (Species) | CCI Score | PSI | PSI Interpretation | Notable Taxa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 020_IA1_057002 | Stoke Brook | 11 | 27 | 2,376 | 76 | 4.00 | 19 | 6.56 | 6.74 | 4.41 | 37.50 | Moderately sedimented | No notable taxa present |
| 020_IA1_058001 | Stoke Brook | 11 | 12 | 1,411 | 52 | 4.33 | 12 | 7.70 | 7.88 | 4.50 | 63.64 | Slightly sedimented | No notable taxa present |
| 020_IA1_061001 | Sedrup Ditch | 11 | 14 | 1,170 | 58 | 4.46 | 13 | 6.18 | 6.25 | 3.43 | 26.92 | Sedimented | No notable taxa present |
| 020_IA1_063001 | Lower Hartwell Ditch | 11 | 23 | 3,539 | 66 | 3.88 | 17 | 6.25 | 6.50 | 4.20 | 20.83 | Sedimented | No notable taxa present |
| 020_IA1_064001 | River Thame | 11 | 25 | 733 | 83 | 4 | 19 | 6.00 | 6.70 | 3.92 | 35.00 | Sedimented | No notable taxa present |
| 020_IA1_064002 | River Thame | 11 | 21 | 1,686 | 63 | 4.20 | 15 | 6.53 | 6.69 | 4.07 | 38.89 | Sedimented | No notable taxa present |
| 020_IA1_065001 | Fleet Marston Brook | 11 | 18 | 2,197 | 63 | 3.94 | 16 | 5.50 | 5.73 | 4.07 | 0.00 | Heavily sedimented | No notable taxa present |
| 020_IA1_070001 | Marston Brook | 12 | 11 | 493 | 25 | 3.13 | 8 | 4.00 | 5.63 | 9.29 | 4.55 | Heavily sedimented | A single snail of 'Local' conservation interest, *Anisus leucostoma* |
| 020_IA1_074001 | River Ray | 12 | 12 | 215 | 40 | 5.00 | 8 | 5.13 | 6.71 | 1.17 | 17.65 | Heavily sedimented | No notable taxa present |
| 020_IA1_076001 | Muxwell Brook | 12 | 21 | 1,988 | 69 | 4.31 | 16 | 5.71 | 5.17 | 15.40 | 15.56 | Heavily sedimented | Two 'Notable' beetle species, *Agabus melanarius* and *Enochrus affinis* (not RDB 1-3, but occur in fewer than a hundred 10km squares of the UK National Grid) |

| Ecology survey code | Watercourse | CFA | Total Number of Taxa in Sample | Total Abundance in Sample | BMWP Score | ASPT | N-Taxa | LIFE Score (Family) | LIFE Score (Species) | CCI Score | PSI | PSI Interpretation | Notable Taxa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 020_IA1_076003 | Muxwell Brook | 12 | 12 | 813 | 42 | 4.20 | 10 | 5.33 | 5.57 | 6.00 | 7.69 | Heavily sedimented | No notable taxa present |
| 020_IA1_081001 | Unknown Tributary of Padbury Brook (Padbury Ditch?) | 13 | 23 | 1,342 | 65 | 4.06 | 16 | 5.21 | 6.19 | 3.43 | 12.12 | Heavily sedimented | No notable taxa present |
| 020_IA1_082001 | Padbury Brook | 13 | 19 | 624 | 74 | 5.29 | 14 | 6.85 | 7.08 | 9.62 | 28.57 | Sedimented | One species of 'Local' conservation interest, the caddisfly *Polycentropus kingii* |
| 020_IA1_083001 | Padbury Brook (Tributary) | 13 | 21 | 618 | 69 | 4.31 | 16 | 6.13 | 6.00 | 3.69 | 15.79 | Heavily sedimented | No notable taxa present |
| 020_IA1_083002 | Padbury Brook (Tributary) | 13 | 16 | 135 | 67 | 5.15 | 13 | 7.60 | 8.13 | 3.00 | 56.52 | Moderately sedimented | No notable taxa present |
| 020_IA1_092001 | River Great Ouse | 14 | 22 | 694 | 105 | 5.53 | 19 | 7.06 | 7.38 | 7.00 | 40.00 | Sedimented | No notable taxa present |
| 020_IA1_095001 | River Great Ouse | 14 | 25 | 3,047 | 117 | 5.57 | 21 | 7.50 | 8.28 | 8.53 | 60.00 | Moderately sedimented | 1 species of 'Local' conservation interest, the caddisfly *Polycentropus kingii* |
| 020_IA1_099001 | River Great Ouse & Backwaters | 14 | 22 | 1,166 | 71 | 5.07 | 14 | 6.38 | 7.14 | 8.50 | 35.14 | Sedimented | Locally important Alderfly larvae *Sialis fuliginosa* present |
| 020_IA1_101001 | Tributary of the River Ouse | 15 | 16 | 173 | 41 | 4.10 | 10 | 5.00 | 7.43 | 3.86 | 38.10 | Sedimented | No notable taxa present |
| 020_IA1_104001 | Lower Thorpe Brook (a | 15 | 11 | 852 | 43 | 4.30 | 10 | 7.14 | 8.57 | 4.71 | 59.09 | Moderately | No notable taxa present |

| Ecology survey code | Watercourse | CFA | Total Number of Taxa in Sample | Total Abundance in Sample | BMWP Score | ASPT | N-Taxa | LIFE Score (Family) | LIFE Score (Species) | CCI Score | PSI | PSI Interpretation | Notable Taxa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tributary of the River Cherwell) | | | | | | | | | | | sedimented | |
| 020_lA1_112002 | Highfurlong Brook | 15 | 13 | 695 | 42 | 3.82 | 11 | 7.13 | 7.29 | 1.00 | 34.78 | Sedimented | No notable taxa present |
| 020_lA1_114001 | Boddington canal feeder | 15 | 17 | 646 | 62 | 4.13 | 15 | 5.71 | 5.79 | 11.08 | 3.03 | Heavily sedimented | A single 'Notable' beetle species *Haliplus laminatus*. Not in RDB categories 1-3 but scarce in Great Britain |

# 4 White-clawed crayfish

## 4.1 Introduction

4.1.1 This section of the appendix presents a summary of the baseline data relating to white-clawed crayfish for the section of the Proposed Scheme that will pass through CFA 7 to 15 inclusive.

## 4.2 Methodology

4.2.1 Details of the standard methodology for white-clawed crayfish survey are provided in Technical Note HS2 Ecological Surveys: Field Survey Methods and Standards which is included as an appendix to Volume 1.

4.2.2 Desk study records relating to white-clawed crayfish were obtained from the Environment Agency (Thames North East, Thames North West and Anglian Central).

4.2.3 Table 7 provides a summary of watercourses and water bodies subject to survey and the various methods employed at each water body/water course. The initial scoping surveys for each location were undertaking during the River Corridor Surveys.

Table 7: Summary of surveys for white-clawed crayfish undertaken within CFA 7 to 15 inclusive

| Ecology Survey Code | Water body/watercourse | Location | Survey method and survey dates | | | CFA | Distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|---|---|
| | | | Scoping visit | Manual search | Trapping | | |
| 020-RS1-061002 | Tributary of Sedrup Ditch | SP810115 | 13/06/13 | N/A | N/A | 11 | Within the Proposed scheme |
| 020-RS1-061001 | Sedrup Ditch | SP807118 | 09/05/13 | N/A | N/A | 11 | Within the Proposed scheme |
| 020-RS1-062001<br>020-WC2-062-001 | Hartwell Ditch/Bear Brook | SP798129 | 31/05/13 and 30/07/13 | 30/07/13 | N/A | 11 | Within the Proposed scheme |
| 020-RS1-063001 | Lower Hartwell Ditch | SP797130 | 31/05/13 and 30/07/13 | N/A | N/A | 11 | Within the Proposed scheme |
| 020-RS1-066001 | Tributary to Fleet Marston Brook | SP772159 | 08/05/13 and 30/07/13 | N/A | N/A | 11 | Within the Proposed scheme |
| 020-RS1-070001 | Fleet Marston Brook | SP741183 | 23/05/13 and 31/07/13 | N/A | N/A | 12 | Within the Proposed scheme |
| 020-RS1-074001, 020-WC2-074001 | River Ray | SP709212 | 31/07/13 | 31/07/13 | N/A | 12 | Within the Proposed scheme |
| 020-RS1-076001 | Tributary of the River Ray | SP702228 | 22/05/13 and | N/A | N/A | 12 | Within the Proposed scheme |

| Ecology Survey Code | Water body/watercourse | Location | Survey method and survey dates | | | CFA | Distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|---|---|
| | | | Scoping visit | Manual search | Trapping | | |
| | | | 31/07/13 | | | | |
| 020-RS1-084001, 020-WC2-084001, 020-WC3-084001 | Padbury Brook | SP651281 | 03/06/13 | 31/07/13 | 31/07/13-01/08/13 | 13 | Within the Proposed scheme |
| 020-RS1-087001, 020-WC2-087001 | Tributary of Padbury Brook | SP633304 | 29/05/13 | 30/07/13 | N/A | 13 | Within the Proposed scheme |
| 020-RS1-091001 | Tributary River Great Ouse | SP616344 | 29/05/13 | N/A | N/A | 14 | Within the Proposed scheme |
| 020-RS1-097001 | Cardinham Water (Tributary to the Great Ouse) | SP587402 | 30/05/13 and 29/07/13 | N/A | N/A | 14 | Within the Proposed scheme |
| 020-RS1-098001 | Tributary to the Great Ouse | SP580408 | 30/05/13 and 29/07/13 | N/A | N/A | 14 | Within the Proposed scheme |
| 020-RS1-099001, 020-WC2-099001 | Tributary to the Great Ouse | SP577412 | 30/05/13 | 29/07/13 | N/A | 14 | Within the Proposed scheme |
| 020-RS1-105001, 020-WC2-105001 | Lower Thorpe Brook (a tributary of the River Cherwell) | SP536454 | 07/05/13 | 30/07/13 | N/A | 15 | Within the Proposed scheme |
| 020-RS1-113001, 020-WC2-113001 | Highfurlong Brook | SP483511 | 06/06/13 | 30/07/13 | N/A | 15 | Within the Proposed scheme |

## 4.3 Deviations, constraints and limitations

4.3.1 Scoping surveys at the locations shown in Table 8 would have been carried out but access was not granted. Further description of these locations is provided in the sections below.

Table 8: Locations where surveys would have been carried out had access been granted

| Ecology Survey Code | Watercourse/ water body | Location | OS grid reference | CFA | Distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|
| 020-WC1-071002 | Ditch flowing to Doddershall Brook | West of Buckingham Railway Centre | SP734 190 | 12 | Within the Proposed scheme |
| 020-WC1-071001 | Ditch flowing to Doddershall Brook | West of Buckingham Railway Centre | SP735190 | 12 | Within the Proposed scheme |
| 020-WC1- | Doddershall Brook | North-east of | SP724204 | 12 | Within the Proposed scheme |

| Ecology Survey Code | Watercourse/ water body | Location | OS grid reference | CFA | Distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|
| 073001 | | Doddershall House | | | |
| 020-WC1-079001 | Drain from Nature Reserve | South-east of Shepherd's Furze Farm | SP685252 | 13 | Within the Proposed scheme |
| 020-WC1-087002 | Weare Street Gill | Near Newton Purcell | SP630310 | 14 | Within the Proposed scheme |

### CFA12

4.3.2 Doddershall Brook and tributary ditches - there are no Environment Agency records for white-clawed crayfish or signal crayfish in the area and thus scoping surveys would have been undertaken if access had been granted. However, the locations where the Proposed Scheme crosses watercourses in this area, from the OS base map, appear to be small ditches/drains. Given that records identified that similar ditches/drains nearby did not contain crayfish, it is considered unlikely that they would be found at these locations.

### CFA13

4.3.3 Drain from Calvert Nature Reserve Lake LWS - there are no Environment Agency records for white-clawed crayfish or signal crayfish in the area and thus scoping surveys would have been undertaken if access had been granted. However, nature reserves tend to be well surveyed areas and if white-clawed crayfish were present (or had been in the past) then it is likely that records would exist. Therefore, it is considered unlikely that the drain from the nature reserve would contain white-clawed crayfish.

### CFA14

4.3.4 Drain into Weare Street Gill near Newton Purcell - there are no Environment Agency records for white-clawed or signal crayfish in the area and thus scoping surveys would have been undertaken if access had been granted. This site, however, is approximately 750m upstream of a site that was surveyed (Tributary of Padbury Brook - SP463230) and where crayfish were not recorded. The route crossing location also appears, from the OS base map, to be a small drain adjacent to an existing culvert. Therefore, it is unlikely that it would contain white-clawed crayfish.

## 4.4 Baseline

4.4.1 Watercourses and water bodies which were not included in the scope of further surveys are listed in Table 9 with reasons for the exclusions in each case.

Table 9: Rationale for scoping out requirement for further crayfish survey of watercourses/water bodies in CFA 7 to 15 inclusive

| Watercourse/ water body | Location | OS grid reference | Rationale for scoping watercourse/water body out of requirement for further survey | CFA | Distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|
| Newyears Green Bourne | Buckinghamshire, South Harefield | TQ058877 | Well known populations of non-native red swamp crayfish in nearby Harefield Pits | 7 | Within the Proposed Scheme |
| Grand Union Canal | Buckinghamshire, South Harefield | TQ051881 | Well known populations of signal crayfish in the River Colne which is connected | 7 | Within the Proposed Scheme |
| Mid Colne Lakes (Broadwater, Korda, Harefield Moor and Long Pond) | Hertfordshire, Denham | TQ044896, TQ045886, TQ046889, TQ043889 | Well known populations of signal crayfish | 7 | Within the Proposed Scheme |
| River Colne | Hertfordshire, Denham | TQ042890 | Signal crayfish present (recorded upstream at Halfway House public house (Rickmansworth) - and in adjacent lakes (see above) | 7 | Within the Proposed Scheme |
| River Misbourne | Buckinghamshire, HS2 tunnel would cross at Chalfont St. Giles and upstream of Shardeloes Lake | SU992937, SU 938983 | Signal crayfish present. Recorded during fish surveys | 8 | Within the Proposed Scheme |
| Tributary of Stoke Brook | Buckinghamshire, Near Stoke Mandeville | SP843091 | Signal crayfish recorded in Stoke Brook during HS2 fish surveys (2013) and by the EA (upstream of Bear Brook), in 2009 | 11 | Within the Proposed Scheme |
| Stoke Brook | Buckinghamshire, Near Stoke Mandeville | SP839094 | Signal crayfish present. Recorded during HS2 fish surveys (2013) and by the EA (upstream of Bear Brook), in 2009 | 11 | Within the Proposed Scheme |
| Tributary of Sedrup Ditch | Buckinghamshire, Near Bishopstone | SP810115 | Scoping survey showed site to be unsuitable as it had low water levels | 11 | Within the Proposed Scheme |
| Sedrup Ditch | Buckinghamshire, Near Bishopstone | SP807118 | Scoping survey showed site to be unsuitable, very little water, maximum depth 5cm | 11 | Within the Proposed Scheme |
| Lower Hartwell Ditch | Buckinghamshire. Aylesbury Park Golf course | SP797130 | Original scoping survey (31/05/13) identified suitable habitat but the ditch had completely dried out when the return visit was undertaken (30/07/13 ) | 11 | Within the Proposed Scheme |

| Watercourse/ water body | Location | OS grid reference | Rationale for scoping watercourse/water body out of requirement for further survey | CFA | Distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|
| Tributary to Thame | Buckinghamshire. Near Aylesbury | SP787142 | Signal crayfish present nearby, in the Thame. Recorded during HS2 fish surveys | 11 | Within the Proposed Scheme |
| Thame and Tributaries | Buckinghamshire. Near Aylesbury | SP784145 | Signal crayfish present in the Thame. Recorded during HS2 fish surveys | 11 | Within the Proposed Scheme |
| Tributary to Fleet Marston Brook | Buckinghamshire, Fleet Marston | SP772159 | Scoping survey on 08/05/13 identified suitable habitat but ditch had dried out when return visit was undertaken (30/07/13) | 11 | Within the Proposed Scheme |
| Fleet Marston Brook | Buckinghamshire, Fleet Marston | SP741183 | Scoping survey on 23/05/13 identified suitable habitat but ditch had dried out when return visit was undertaken (31/07/13) | 11 | Within the Proposed Scheme |
| Tributary of the River Ray | Buckinghamshire, Calvert | SP702228 | Scoping survey on 22/05/13 identified suitable habitat but ditch had almost dried out when return visit was undertaken (31/07/13) | 12 | Within the Proposed Scheme |
| Padbury Brook | Buckinghamshire, Preston Bisset | SP665270 | Signal crayfish recorded close to site just upstream 31/07/13 during HS2 crayfish survey, therefore negating the need for further surveys downstream | 13 | Within the Proposed Scheme |
| Tributary of Padbury Brook | Buckinghamshire, Preston Bisset, | SP664271, SP670267 | Signal crayfish recorded close to site just upstream 31/07/13 during HS2 crayfish surveys, therefore negating the need for further surveys downstream | 13 | Within the Proposed Scheme |
| Tributary River Great Ouse | Buckinghamshire, Newton Purcell | SP616344 | Scoping survey showed site to be unsuitable (no water) | 14 | Within the Proposed Scheme |
| River Great Ouse | Buckinghamshire, Newton Purcell | SP612356 | Signal crayfish present in the Great Ouse, recorded during HS2 fish surveys | 14 | Within the Proposed Scheme |
| Cardinham Water (Tributary to the Great Ouse) | Buckinghamshire,Radstone | SP587402 | Access to the watercourse was very difficult and the habitat was sub-optimal for crayfish | 14 | Within the Proposed Scheme |
| Tributary to the | Buckinghamshire, Greatworth | SP580408 | Scoping survey showed site to | 14 | Within the Proposed |

| Watercourse/ water body | Location | OS grid reference | Rationale for scoping watercourse/water body out of requirement for further survey | CFA | Distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|
| Great Ouse | | | be unsuitable (no water) | | Scheme |
| Cherwell and Tributaries | Buckinghamshire, Lower Thorpe | SP517479, SP541447 | Environment Agency record for signal crayfish at Trafford Bridge (2008) | 15 | Within the Proposed Scheme |
| Tributary to Boddington canal feeder | Northamptonshire, Lower Boddington | SP478517 | Scoping survey showed site to be unsuitable (no water in summer) | 15 | Within the Proposed Scheme |
| Drain to Boddington canal feeder from Boddington reservoir | Northamptonshire, Lower Boddington | SP471524 | Scoping survey showed site to be unsuitable for crayfish as it was a canalised watercourse with no suitable features and not practical to survey due to accessibility constraints. | 15 | Within the Proposed Scheme |

4.4.2 Table 10 provides data for sites where detailed field survey was undertaken.

Table 10: Summary of crayfish records from surveys undertaken in CFA 7 to 15 inclusive

| Ecology survey code | Location and watercourse | OS grid reference | Species recorded and number | Survey method yielding record | CFA | Distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|---|
| 020-WC3-084-001 | Padbury Brook | SP651281 | Signal Crayfish (55) | Trapping survey (30 traps deployed) | 13 | Within the Proposed Scheme |
| 020-WC2-105-001 | Thorpe Mandeville, Lower Thorpe Brook (a Tributary of the River Cherwell) | SP536454 | Signal Crayfish (1) | Manual search, artificial refugia and netting | 15 | Within the Proposed Scheme |

4.4.3 The EA supplied records for white-clawed crayfish but the most recent is from 1989 at Trafford Bridge on the River Cherwell and signal crayfish have subsequently been recorded at this location.

## 4.5 Discussion of results by Community Forum Area.

### CFA7 to 15 inclusive

4.5.1 There is no evidence that native white-clawed crayfish are present in the watercourses along the length of the Proposed Scheme and specifically at the crossing points within the Proposed Scheme in any CFA. A number of sites were scoped out owing to the presence of signal crayfish. This is because signal crayfish out-compete white-clawed

crayfish and also carry crayfish plague. Crayfish plague is a fungal disease (*Aphanomyces astaci*) that wipes out white-clawed crayfish populations.

## CFA7

### *Newyears Green Bourne*

4.5.2 Newyears Green Bourne could not be surveyed as no access was available; however, this connects with water bodies (Harefield Pits) which have well known populations of non-native crayfish (probably red swamp crayfish). The presence of non-native crayfish means it is unlikely that white-clawed crayfish would be present.

### *River Colne and Mid Colne Lakes*

4.5.3 River Corridor and River Habitat Surveys were undertaken, in 2013, on the reaches of the River Colne that would be impacted by the Proposed Scheme. However, although suitable habitat for white-clawed crawfish is present, signal crayfish are present both in the River Colne and the adjacent lakes. Surveys undertaken in 2011, 2012 and 2013 by Mott MacDonald on behalf of Affinity Water recorded signal crayfish at Halfway House pub (Rickmansworth), which is approximately 5.5km upstream of where the Proposed Scheme would cross the River Colne.

4.5.4 The Mid Colne Lakes (Broadwater, Korda, Harefield Moor and Long Pond) have well known populations of signal crayfish.

4.5.5 As there are no recent records for white-clawed crayfish and because the presence of signal crayfish is confirmed for the catchment, surveys at the crossing points within CFA7 were not deemed necessary.

## CFA8

### *River Misbourne*

4.5.6 Signal crayfish are known to be present in the River Misbourne and they were recorded in 2013 during fish surveys for the Proposed Scheme.

4.5.7 As there are no recent records for white-clawed crayfish remaining in the area and the presence of signal crayfish is confirmed for the catchment, surveys at the crossing points were not deemed necessary.

## CFA9 and 10

4.5.8 There are no river crossings within CFA's9 and 10 that are potentially suitable for white-clawed crayfish and that are in the Proposed Scheme.

## CFA11

### *Stoke Brook*

4.5.9 Signal crayfish are known to be present in Stoke Brook and were recorded during fish surveys for the Proposed Scheme in 2013. There are also EA records for signal crayfish in Stoke Brook from 2009. No further surveys were undertaken..

### *Thame and Tributaries*

4.5.10 Signal crayfish are known to be present in the River Thame and the tributaries that would be impacted by the construction of the Proposed Scheme. Signal crayfish were recorded in the River Thame during fish surveys for the Proposed Scheme in 2013. There are also EA records for signal crayfish in the Thame and Bear Brook from 2011. No further surveys were undertaken.

### *Sedrup Ditch*

4.5.11 Scoping surveys were undertaken on Sedrup Ditch and one of its tributaries. The tributary only had water present for a length of 150m before it ceased to exist. The habitat was deemed unsuitable for crayfish owing to very low water levels and further surveys at the crossing points were not deemed necessary. The EA has records for signal crayfish in Stoke Brook downstream of Sedrup ditch from 2011 and so the presence of white-clawed crayfish is unlikely.

### *Hartwell Ditches, Bear Brook*

4.5.12 Scoping surveys were carried out at the Hartwell ditches; one at Hartwell Ditch and one at Lower Hartwell. The Hartwell ditches flow into Bear Brook which flows into the River Thame. A scheduled return to the sites on the 30 July 2013 discovered that some ditches had dried out. Manual searches and netting were carried out in suitable habitat on the remaining ditches but no white-clawed crayfish (or signal crayfish) were present. White-clawed crayfish are therefore considered likely to be absent.

### *Fleet Marston Brook and Tributaries*

4.5.13 Scoping surveys were carried out at Fleet Marston Brook and two of its tributaries. These surveys identified suitable habitat for crayfish; however, a further visit on 30 July 2013 found that these watercourses had dried out and were unsuitable.

## CFA12

### *Fleet Marston Brook*

4.5.14 The Proposed Scheme will cross Fleet Marston Brook on the boundary between CFA11 and CFA12. A scoping survey was carried out which identified suitable habitat for crayfish. However, a further visit on 30 July 2013 found that this watercourse had dried out and so was unsuitable for crayfish.

### *Doddershall Brook*

4.5.15 Doddershall Brook and tributary ditches were identified as requiring a scoping survey but access was not available. The site, however, is considered to have low potential for white-clawed crayfish as the locations where land required for the construction of the Proposed Scheme crosses the Brook appear, from the OS base map, to be small ditches/drains. Given that other similar ditches/drains nearby did not contain white-clawed crayfish, it is considered unlikely that they would be found at these locations.

### *River Ray*

4.5.16 Scoping surveys were undertaken on the River Ray and a tributary of the River Ray which identified suitable habitat for crayfish. However, during a second visit

undertaken on the 31 July 2013 it was discovered that the tributary had almost completely dried out. Manual search surveys were conducted at Quainton on the River Ray and no evidence of crayfish was discovered. Therefore, it is likely that white-clawed crayfish are absent.

## CFA13

### *Padbury Brook and Tributaries*

4.5.17 Scoping surveys were carried out on Padbury Brook and its tributaries, close to where the Proposed Scheme would cross and where suitable habitat for crayfish was identified. There are EA records for signal crayfish in Padbury Brook at Stratton Audley Mill from 2009. Manual searches and netting were undertaken on a tributary at Newton Purcell and bullhead (*Cottus gobio*) fish were discovered, which are known to be associated with native crayfish but no evidence of native crayfish was found. Trapping was undertaken in Padbury Brook at Grange Farm and signal crayfish were discovered to be abundant. White-clawed crayfish are therefore considered to be absent.

### *Drain from Calvert Nature Reserve LWS*

4.5.18 The drain from Calvert Nature Reserve LWS was identified for survey but no access was available. The site, however, is considered to have low potential for white-clawed crayfish. This is because nature reserves tend to be well surveyed areas and so if white-clawed crayfish were present (or had been in the past) then it is likely records would exist. Therefore, it is considered unlikely that the drain from the nature reserve contains white-clawed crayfish.

## CFA14

### *Great Ouse*

4.5.19 Signal crayfish are known to be present in the River Great Ouse and its tributaries and were recorded during fish surveys for the Proposed Scheme in 2013. No further surveys were undertaken as white-clawed crayfish are considered to be absent. This is because signal crayfish out-compete white-clawed crayfish and also carry crayfish plague.

### *Drain to Weare Street Gill*

4.5.20 The Drain to Weare Street Gill was identified for survey but no access was available. The site, however, is considered to have low potential for white-clawed crayfish. This is because it is approximately 750m upstream of a site which was surveyed (Tributary of Padbury Brook - SP463230) where no crayfish were found. The Proposed Scheme crossing location also appears, from the OS base map, to be a small drain adjacent to an existing culvert. Therefore, it is unlikely that it would contain white-clawed crayfish.

## CFA15

### *Cherwell and Tributaries*

4.5.21 EA records confirm the presence of signal crayfish in the Cherwell. White-clawed crayfish were last recorded in the Cherwell in 1989 and signal crayfish were recorded at Trafford Bridge during 2008. Manual searches recorded signal crayfish in a tributary of the Cherwell at Thorpe Mandeville. Therefore white-clawed crayfish are likely to be absent.

### *Highfurlong Brook and Boddington canal feeder*

4.5.22 Manual searches and netting were carried out near Lower Boddington on Highfurlong Brook and no evidence of crayfish was discovered. Therefore, white-clawed crayfish are likely to be absent.

# 5 Fish (Rivers/Streams)

## 5.1 Introduction

5.1.1 This section of the appendix presents details of the baseline information relating to fish in rivers and streams for the section of the Proposed Scheme that will pass through CFA7 to 15 inclusive.

## 5.2 Methodology

5.2.1 Fish survey requirements were devised in each route section through consultation with the local Environment Agency teams. A desk based study was carried out to identify all lotic water bodies within 500m of land required for the construction of the Proposed Scheme. Where access was available each water body was assessed for fish habitat potential. Where surveys revealed good or moderate habitat, electric fishing surveys were scheduled in. Where water bodies scored poorly but were likely to be more heavily impacted by the project, electric fishing surveys were also carried out. All electric fishing surveys were carried out in accordance with HS2 Ecological Surveys: Field Survey Methods and Standards.

5.2.2 Desk study records relating to fish in lotic systems were obtained from the Environment Agency

5.2.3 A summary of locations at which fish surveys were undertaken within the section of the Proposed Scheme that will pass through CFA7 to 15 inclusive is provided in Table 11.

Table 11: Summary of fish survey locations

| Ecology survey code | Watercourse/ feature | Survey date | Survey methods utilised | CFA | Approximate distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|
| 020-FI1-027001 | River Colne (d/s), River (main river). | 16 May 2013 | Electric fishing | 7 | 26m west |
| 020-FI1-028001 | River Colne (middle), River (main river) | 16 May 2013 | Electric fishing | 7 | Within the Proposed Scheme |
| 020-FI1-028002 | River Colne (u/s), River (main river) | 15 May 2013 | Electric Fishing | 7 | 239m East |
| 020-FI1-036001 | Misbourne, River (main river) | 13 June 2013 | Electric Fishing | 8 | 111m north west |
| 020-FI1-041001 | Misbourne, River (main river) | 30 May 2013 | Electric Fishing | 8 | 1233m east |
| 020-FI1-053001 | Castle Park Stream (river) | 23 May 2013 | Electric Fishing | 10 | 372m north east |
| 020-FI1-056001 | Tributary of Stoke Brook (river) | 23 May 2013 | Electric Fishing | 10 | 386m south west |

| Ecology survey code | Watercourse/ feature | Survey date | Survey methods utilised | CFA | Approximate distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|
| 020-Fl1-057001 | Stoke Brook (river) | 20 May 2013 | Electric Fishing | 11 | Within the Proposed Scheme |
| 020-Fl1-057002 | Stoke Brook (river) | 20 May 2013 | Electric Fishing | 11 | Within the Proposed Scheme |
| 020-Fl1-058001 | Stoke Brook (river) | 24 May 2013 | Electric Fishing | 11 | Within the Proposed Scheme |
| 020-Fl1-061001 | Sedrup Ditch (ditch) | 21 May 2013 | Electric Fishing | 11 | 173m south west |
| 020-Fl1-063001 | Hartwell Ditch (ditch) | 21 May 2013 | Electric Fishing | 11 | 90m north east from the Proposed Scheme |
| 020-Fl1-064001 | Thame River (main river) | 06 April 2013 | Electric Fishing | 11 | 21m south west from the Proposed Scheme |
| 020-Fl1-064002 | Thame River (main river) | 06 April 2013 | Electric Fishing | 11 | 105m north east from the Proposed Scheme |
| 020-Fl1-065001 | Fleet Marston Brook (river) | 24 May 2013 | Electric Fishing | 11 | 87m north east from the Proposed Scheme |
| 020-Fl1-074001 | River Ray River (main river) | 22 May 2013 | Electric Fishing | 12 | 70m west from the Proposed Scheme |
| 020-Fl1-076001 | Muxwell (brook, river) | 06 June 2013 | Electric Fishing | 12 | Within the Proposed Scheme |
| 020-Fl1-081001 | Tributary of Padbury Brook (river) | 22 May 2013 | Electric Fishing | 13 | Within the Proposed Scheme |
| 020-Fl1-083001 | Tributary of Padbury Brook, (river) | 13 June 2013 | Electric Fishing | 13 | 42m south west from the Proposed Scheme |
| 020-Fl1-084001 | Padbury Brook River (main river) | 13 June 2013 | Electric Fishing | 13 | Within the Proposed Scheme |
| 020-Fl1=087001 | Tributary of Padbury Brook (river) | 28 June 2013 | Electric Fishing | 13 | Within the Proposed Scheme |
| 020-Fl1-092001 | River Great Ouse (main river) | 28 May 2013 | Electric Fishing | 14 | 233m east from the Proposed Scheme |
| 020-Fl1-095001 | River Great Ouse (main river) | 23 May 2013 | Electric Fishing | 14 | 492m west from the Proposed Scheme |
| 020-Fl1-099001 | Tributary of Great Ouse (river) | 06 June 2013 | Electric Fishing | 14 | Within the Proposed Scheme |
| 020-Fl1-101001 | Tributary of Great Ouse (river) | 29 May 2013 | Electric Fishing | 15 | Within the Proposed Scheme |
| 020-Fl1-104001 | Lower Thorpe Brook (river) | 28 May 2013 | Electric Fishing | 15 | Within the Proposed Scheme |
| 020-Fl1-113001 | Highfurlong Brook (river) | 30 May 2013 | Electric Fishing | 15 | 55m east from the Proposed Scheme |

| Ecology survey code | Watercourse/ feature | Survey date | Survey methods utilised | CFA | Approximate distance from the Proposed Scheme (m) and orientation |
|---|---|---|---|---|---|
| 020-FI1-114001 | Boddington Canal Feeder (artificial channel) | 06 May 2013 | Electric Fishing | 15 | Within the Proposed Scheme |

## 5.3 Deviations, constraints and limitations

A number of water bodies could not be surveyed due to limited access; these are detailed in the sections below.

### *CFA7*

5.3.1 Grand Union Canal (km marker 026). Fish habitat was rated as moderate, although largely homogenous. No access for electric fishing was possible and no recent fisheries data is available for this reach of the Grand Union Canal. The canal is classified as a Cyprinid Water under the Freshwater Fish Directive[6].

### *CFA8*

5.3.2 Additional catchment-wide monitoring of the River Misbourne was planned but the limited access meant this wasn't possible in full. Where possible, Environment Agency data has been used to augment more recent data collection.

### *CFA10*

5.3.3 Wendover Brook (km marker 054). Fish habitat was rated as moderate; no access for electric fishing survey was possible.

### *CFA13*

5.3.4 Padbury Brook (km marker 082). No access was available, although a survey took place at an upstream crossing point (020-FI1-084001) on the same water body. Recent Environment Agency data exists from within 500m of land required for the Proposed Scheme.

5.3.5 Padbury Brook tributary (km marker 087). No access was available due to landowner issues.

### *CFA15*

5.3.6 River Cherwell and two small un-named tributaries (km marker 108). No access was possible, therefore no fisheries data was collected. Recent Environment Agency data is available.

[6] *Directive 2006/44/EC Freshwater Fish Directive*

## 5.4 Baseline

### Desk study

#### *CFA7*

**Colne - Denham**

5.4.1 Annual Environment Agency data exists for between 2003 and 2011 for a site falling within land required for the proposed scheme on the River Colne. Four species were found in the last electric fishing survey carried out in May 2011; brown trout (*Salmo trutta*), dace (*Leuciscus leuciscus*), perch (*Perca fluviatilis*) and eel (*Anguilla anguilla*). Eel is listed as Critically Endangered by the IUCN, and is a UKBAP priority species. Both eel and brown trout are listed as species of principal importance in the Natural Environment and Rural Communities Act 2006).

5.4.2 Fish density was low, as only 28 fish were caught within a 100m section. A single brown trout was recorded; these are relatively rare on the main River Colne and may originate from the connected chalk fed rivers such as the River Misbourne and River Chess. Five eel were also recorded.

#### *CFA8*

**Misbourne - Denham Country Park**

5.4.3 This site on the lower Misbourne was surveyed using standard electric fishing techniques on 7 June 2012. Nine species of fish were recorded, with minnow (*Phoxinus phoxinus*) and bullhead (*Cottus gobio*) being dominant. Three-spined stickleback (*Gasterosteus aculeatus*), stone loach (*Barbatula barbatula*), chub, roach (*Rutilus rutilus*), pike (*Esox lucius*), eel and perch were present in low numbers. Bullhead are listed in Annex IIa of the EU Habitats and Species Directive. This site is 530m from the confluence of the Misbourne and the River Colne, which will contribute to the presence of larger cyprinids such as chub and roach.

**Misbourne - d/s Shardeloes Lake**

The most recent Environment Agency electric fishing survey occurred on this upper Misbourne site in May 2011. Four species were recorded, with rudd (*Scardinius erythrophthalmus*) making up a significant amount of fish biomass; brown trout, bullhead and three-spined stickleback were also present. Rudd are usually associated with lentic habitats and would not be a species expected in the upper reaches of a chalk stream. It is likely that this population is seeded from the online lake immediately above the survey site. It appears a self-sustaining brown trout population exists at the site. Bullhead are present at low densities, potentially due to the presence of signal crayfish (*Pacifastacus leniusculus*) that have been shown to have a detrimental effect on bullhead through competition for shelter and food, and through predation.

#### *CFA9 - 12*

5.4.4 No desk study data available.

## *CFA13*

### Padbury Brook - d/s Twyford Mill

5.4.5 The most recent electric fishing survey undertaken by the Environment Agency occurred on 3 June 2010. Ten fish species were present with gudgeon (*Gobio gobio*) and roach dominant; bullhead, three-spined-stickleback, chub, dace, minnow, perch, pike, and stone loach were also present. Although a diverse range of species were present fish density was low, indicating pressures on the population.

## *CFA14*

### Great Ouse-Westbury

5.4.6 The most recent electric fishing survey undertaken by the Environment Agency occurred on 30 June 2008. Ten species of fish were recorded, including brown trout and bullhead indicating a reasonable quality of habitat and water quality. Other species recorded were chub, dace, gudgeon, minnow, perch, pike, roach and stone loach. In previous years brook lamprey (*Lampetra planeri*) and three-spined stickleback have also been recorded at this site. Brook Lamprey are listed in Annex IIa of the EU Habitats Directive, in Appendix III of the Bern Convention and are a species of principal importance[7]

### Great Ouse Turweston

5.4.7 The most recent electric fishing survey undertaken by the Environment Agency took place on 1 October 2008. Six species of fish were recorded including brown trout and bullhead, indicating a reasonable quality of habitat and water quality. Dace, minnow, perch, pike and stone loach were also present.

## *CFA15*

### Cherwell - Trafford Bridge

5.4.8 The River Cherwell is classified as a Cyprinid water under the Freshwater Fish Directive. The Trafford Bridge site is an existing Environment Agency site, partially within land required for the construction of the Proposed Scheme. It was last surveyed using standard electric fishing techniques on 26 May 2011. Roach and common bream (*Abramis brama*) were dominant, with one hybrid of the two species found, possibly suggesting a paucity of available spawning habitat. Pike and perch were also present in low numbers. Fish density was relatively high and the habitat was dominated by phytophilic species (i.e. species which spawn amongst vegetation).

[7] *The National Environment and Rural Communities (NERC) Act 2006*. Natural England.

## *HS2 Data*

5.4.9 Table 12 provides data for sites where detailed field survey was undertaken.

Table 12 Summary of results from fish surveys conducted in CFA7 to 15 inclusive

| Ecology survey code | Watercourse/ Feature | Description of location | Average width (m) | Fish habitat quality score | No. species | Species | Single catch density (no/ 100m$^{2)}$ | CFA |
|---|---|---|---|---|---|---|---|---|
| 020-Fl1-027001 | River Colne | Downstream site. North of Moorhall Road | 12.7 | Good | 3 | Barbel, chub, bullhead | 0.15 | 7 |
| 020-Fl1-028001 | River Colne | Middle site. North of Moorhall Road | 16.0 | Good | 3 | Barbel, perch, bullhead | 0.06 | 7 |
| 020-Fl1-028002 | River Colne | Upstream site. North of Moorhall Road | 16.0 | Good | 6 | Barbel, chub, perch, eel, roach, three-spined stickleback | 0.56 | 7 |
| 020-Fl1-036001 | Misbourne | Pheasant Hill, Chalfont St Giles | 3.0 | Moderate | 1 | Three-spined stickleback | 3 | 8 |
| 020-Fl1-041001 | Misbourne | Downstream of Shardeloes Lake | 8.3 | Good | 4 | Brown trout, rudd, three-spined stickleback, bullhead | 15.72 | 8 |
| 020-Fl1-053001 | Castle Park Stream | Chapel Lane, Wendover | 3.5 | Poor | 1 | Three-spined stickleback | 30.3 | 10 |
| 020-Fl1-056001 | Tributary of Stoke Brook | South of Nash Lee Road | 1.3 | Moderate | 0 | No fish present | 0 | 10 |
| 020-Fl1-057001 | Stoke Brook | East of Risborough Road | 1.3 | Moderate | 2 | Bullhead, three-spined stickleback | 17.25 | 11 |
| 020-Fl1-057002 | Stoke Brook | East of Risborough Road | 1.0 | Poor | 1 | Three-spined stickleback | 12 | 11 |
| 020-Fl1-058001 | Stoke Brook | North west of Marsh Lane | 1.2 | Moderate | 2 | Bullhead, three-spined stickleback | 35.47 | 11 |

| Ecology survey code | Watercourse/ Feature | Description of location | Average width (m) | Fish habitat quality score | No. species | Species | Single catch density (no/ 100m$^{2)}$ | CFA |
|---|---|---|---|---|---|---|---|---|
| 020-Fl1-061001 | Sedrup Ditch | Sedrup | 1.7 | Poor | 1 | Three-spined stickleback | 1.5 | 11 |
| 020-Fl1-063001 | Hartwell Ditch | Aylesbury Park Golf course, east of Lower Hartwell | 1.2 | Moderate | 2 | Bullhead, three-spined stickleback | 12.99 | 11 |
| 020-Fl1-064001 | Thame | South of Putlowes Farm | 8.3 | Moderate | 9 | Bullhead, chub, common bream, roach, perch, three-spined stickleback, pike, minnow, stone loach | 0.83 | 11 |
| 020-Fl1-064002 | Thame | South of Putlowes Farm | 6.7 | Moderate | 4 | Common bream, perch, pike, ornamental carp. | 0.81 | 11 |
| 020-Fl1-065001 | Fleet Marston Brook | South of Putlowes Farm | 1.0 | Moderate | 4 | Bullhead, three-spined stickleback, nine-spined stickleback, stone loach | 18.62 | 11 |
| 020-Fl1-074001 | River Ray | Oak Tree Farm | 1.3 | Moderate | 0 | No fish present | 0 | 12 |
| 020-Fl1-076001 | Muxwell Brook | South of Sheephouse Wood | 0.4 | Poor | 0 | No fish present | 0 | 12 |
| 020-Fl1-081001 | Tributary of Padbury Brook | East of Twyford | 0.9 | Poor | 3 | Three-spined stickleback, 9-spined stickleback, stone loach | 19.93 | 13 |
| 020-Fl1-083001 | Tributary of Padbury Brook | East of Goddington | 1.5 | No fish habitat assessment | 2 | Three-spined stickleback, 9-spined stickleback | 24.76 | 13 |
| 020-Fl1-084001 | Padbury Brook | East of Goddington | 5.5 | No fish habitat assessment | 8 | Bullhead, stone loach, minnow, three-spined stickleback, nine-spined stickleback, pike, roach, dace | 29.79 | 13 |
| 020-Fl1- | Tributary of | South of Barton Hartshorn | 1.2 | Moderate | 1 | Three-spined stickleback. | 5.41 | 13 |

| Ecology survey code | Watercourse/ Feature | Description of location | Average width (m) | Fish habitat quality score | No. species | Species | Single catch density (no/ 100m$^{2)}$ | CFA |
|---|---|---|---|---|---|---|---|---|
| 087001 | Padbury Brook | | | | | | | |
| 020-Fl1-092001 | River Gt. Ouse | South-west of Westbury | 6.7 | No fish habitat assessment | 9 | Brown trout, pike, perch, chub, dace, gudgeon, roach, Bullhead, three-spined stickleback. | 2.9 | 14 |
| 020-Fl1-095001 | River Gt. Ouse | West of Turweston | 4.7 | No fish habitat assessment | 12 | Bullhead, dace, pike, perch, pike, brown trout, chub, , minnow, tench, gudgeon, stone loach, three-spined stickleback | 21.81 | 14 |
| 020-Fl1-099001 | Tributary of Gt. Ouse | North-west of Radstone | 0.8 | Moderate | 2 | Bullhead, three-spined stickleback | 12.73 | 14 |
| 020-Fl1-101001 | Tributary of Gt. Ouse | East of Greatworth | 0.4 | Poor | 1 | Stone loach | 3.57 | 15 |
| 020-Fl1-104001 | Trib of Cherwell | North-east of Thorpe Mandeville | 1.3 | Poor | 1 | Three-spined stickleback | 1.5 | 15 |
| 020-Fl1-113001 | Highfurlong Brook | North-west of Aston le Walls | 2.1 | Poor | 3 | Stone loach, three-spined stickleback, nine-spined stickleback | 72.86 | 15 |
| 020-Fl1-114001 | Boddington Canal Feeder | South of Lower Boddington | 4.0 | Poor | 4 | Roach, perch, three-spined stickleback, nine-spined stickleback | 120 | 15 |

## Discussion

### *CFA7*

5.4.10 Four water bodies were assessed for fish, two of these (New Years Green Bourne and an un-named watercourse to the west of the River Colne) had poor fish habitat and were scoped out from further surveys. The Grand Union Canal was assessed as having moderate fish habitat and is listed as a Cyprinid Water under the Freshwater Fish Directive, although additional surveys were not completed within the timescale due to access restrictions. The water body of significant interest is the River Colne, where generally good fish habitat was present. Fish survey data for the River Colne is presented below.

#### River Colne (020-FI1-027001, 020-FI1-028001, 020-FI1-028002)

5.4.11 The River Colne is classified as a Cyprinid Water under the Freshwater Fish Directive. Three electric fishing surveys were completed within the section to provide information on species within, upstream and downstream of the Proposed Scheme. One survey was conducted upstream of a point where the land required for the construction of the Proposed Scheme will cross the watercourse, one encapsulated the area within land required for the Proposed Scheme and one was conducted downstream. For the purposes of this summary all three sites are discussed together.

5.4.12 Both habitat quality and flows were very good, suggesting a diverse and abundant fish population may be present. Low densities of fish were found with a distinct lack of juveniles even though suitable habitat was present with ample vegetative cover along the river margins Large adult barbel (*Barbus barbus*) dominate, with several year classes missing. Seven species were recorded including eel and bullhead although overall density was extremely low (0.06-0.56 fish/100m$^2$).

### *CFA8*

5.4.13 The predominant watercourse in CFA8 is the River Misbourne, a chalk stream tributary of the River Colne. The Misbourne has catchment-wide issues with low flows, which has significantly impacted on the ecology of the river. Although in many areas fish biomass and density is low due to flow-related impacts there are still areas where self-sustaining wild brown trout populations exist. The lower section (Gerrards Cross Sewage Treatment Works to Colne) of the River Misbourne is classified as a Salmonid Water under the Freshwater Fish Directive.

#### Misbourne (020-FI1-036001)

5.4.14 This site on the middle reaches of the Misbourne had good brown trout spawning and juvenile habitats. Only a small number of three-spined sticklebacks were present indicating that this part of the Misbourne periodically becomes dry, with only adaptable species surviving.

#### Misbourne (020-FI1-041001)

5.4.15 This site is immediately downstream of an online lake, which is likely to provide a more consistent flow regime than other parts of the catchment. Four species were recorded with rudd being the dominant species (217 individuals recorded). Rudd are usually associated with lentic habitats and would not be a species expected in the upper reaches of a chalk stream. It is likely that this population is seeded from the

online lake immediately above the survey site. It appears a self-sustaining brown trout population exists at the site; bullhead is present but at low densities, potentially due to the presence of signal crayfish that have been shown to have a detrimental effect on bullhead through competition for shelter and food and through predation. The presence of a range of year classes of brown trout indicates a healthy, self-sustaining wild population.

### *CFA9*

5.4.16 The Upper Misbourne runs through CFA9 for approximately 6km. No fisheries data are available for this section, although as the section has ephemeral flow it is unlikely to support significant self-sustaining fish populations in the upper reaches.

### *CFA 10*

5.4.17 CFA10 has few watercourses; these are limited to the upper tributary of the Bear Brook, the Castle Park Stream, and a tributary of the Stoke Brook. Wendover Brook has moderate habitat quality; although access was not available for further survey, it is likely that fish populations are consistent with the nearby Castle Park Stream. Any fish populations present are of negligible importance due to the pressures exerted by low flows and habitat degradation.

#### Castle Park Stream (020-FI1-053001)

The upper reaches of this spring fed tributary of the Bear Brook were surveyed and only one species, three-spined stickleback, was present. The stream is likely to be too small to be of importance to larger fish and in summer it will be likley to dry out in the upper reaches.

#### Tributary of Stoke Brook (020-FI1-056001)

5.4.18 Habitat was present for minor species, such as three-spined stickleback and stoneloach, no fish were caught. Vegetation types suggested periodic drying, and obstacles in the channel would preclude upstream colonisation by fish.

### *CFA11*

5.4.19 The Upper Thame and its tributaries are crossed a number of times by land required for the construction of the Proposed Scheme. A number of small watercourses were scoped out because of their poor fish habitat. The remaining watercourses had moderate habitat suitability; where appropriate electric fishing surveys were carried out. Only the River Thame itself had a diverse range of species, although density was low.

#### Stoke Brook (020-FI1-057001, 020-FI1-057002, 020-FI1-058001)

5.4.20 Three sites on Stoke Brook were electric fished. Bullhead and three-spined stickleback were found in low densities throughout. Signal crayfish were present on the upper reaches, which have been shown to have a detrimental impact on small benthic fish such as bullheads.

### Sedrup Ditch (020-FI1-061001)

5.4.21 Providing relatively poor habitat for fish, the site was heavily sedimented with limited flow. Small numbers of three-spined stickleback were recorded. This species is tolerant of poor water quality.

### Hartwell Ditch (020-FI1-063001)

5.4.22 This small tributary of Bear Brook had very little flow and suffered from sediment deposition. Fish habitat was sparse and only suitable for small benthic species. Small numbers of bullhead and three-spined stickleback were recorded.

### River Thame (020-FI1-064001, 020-FI1-064002)

5.4.23 The River Thame is classified as a Cyprinid Water under the Freshwater Fish Directive. Two electric fishing surveys were completed, one above and one below land required for the construction of the Proposed Scheme. Immediately upstream of the sites was a sewage treatment works discharge; it is likely this will have an impact on pollution sensitive species. Ten fish species were recorded, all in low densities (0.81 and 0.83fish/100m$^2$). Juvenile fish were largely absent despite suitable habitat being present in the sites that were surveyed, with populations skewed towards larger individuals. An off-river support unit (ORSU) was present between the two sites; it would be expected that this would provide good juvenile habitat as well as providing refuge for all life stages during flood events.

5.4.24 It is clear that this section of the River Thame is heavily impacted by water pollution and habitat modification, and does not contain the fish communities/densities that would be expected in this habitat type.

### Fleet Marston Brook (020-FI1-065001)

5.4.25 This small tributary of the River Thame was surveyed approximately 220m from its confluence. Four species of fish were recorded, all at low densities. Bullhead were present in low numbers and also nine-spined stickleback (*Pungitius pungitius*), which although locally relatively rare, are not accorded any conservation designation.

## *CFA12*

5.4.26 Two watercourses (the upper reaches of Fleet Marston Brook and Tetchwick Brook) at the southern end of the CFA were scoped out by fish habitat assessment due to poor habitat. At the upstream limits of the Ray catchment a number of small watercourses are crossed, these were all scoped out due to poor habitat or dry watercourses.

### River Ray (020-FI1-074001)

5.4.27 The River Ray is classified as a Cyprinid Water under the Freshwater Fish Directive. This site on the upper reaches of the River Ray has some habitat features such as a naturalised form with pools and riffles that suggest it may be inhabited by occasional populations of the smaller fish species. The channel was heavily overgrown and only 6om of channel could be surveyed, this was however deemed to be representative. No fish were found at this site.

### Muxwell Brook (020-FI1-076001)

5.4.28 The initial fish habitat assessment deemed the site as poor due to low water levels, although enough flow was present to support a fish population. A subsequent visit indicated the site is likely to be dry in summer months..

## *CFA13*

5.4.29 The predominant watercourse in CFA13 is Padbury Brook and some smaller tributaries that are crossed a number of times by the Proposed Scheme. No survey was undertaken on an unknown tributary of Padbury Brook at Barton Hartshorn due to access issues; however, this watercourse scored as moderate in fish habitat assessment. A number of small water bodies were scoped out at the southern end of the CFA due to lack of flow and suitable habitat; these included the Internal Drainage Board IDB watercourses (M23 and M24). Due to the meandering nature of Padbury Brook it is crossed twice by land required for the Proposed Scheme; surveys were undertaken at the more northerly crossing point but access was unavailable at the more southerly crossing point.

### Tributaries of Padbury Brook (020-FI1-081001, 020-FI1-083001)

5.4.30 Many of the minor watercourses within this CFA including the tributaries of the Padbury Brook were classified as having poor fish habitat. Two of these were surveyed and only three species were recorded (three and nine-spined stickleback, and stone loach) at low densities.

### Padbury Brook (020-FI1-084001)

5.4.31 Padbury Brook at Godington has relatively steep banks and poor flood plain connectivity. In-stream habitat, however, was relatively diverse, with eight species of fish recorded. Roach were dominant along with dace and juvenile pike. A diverse assemblage of minor species was present at moderate densities, and the overall fish density was good.

### Tributary of Padbury Brook (020-FI1-087001)

5.4.32 This small tributary of Padbury Brook had moderate fish habitat, although only a small number of three-spined sticklebacks were present when surveyed.

## *CFA14*

5.4.33 A number of small water bodies are crossed by the Proposed Scheme, where fish habitat assessments were carried out they were either classed as poor or dry. Two sites on the Great Ouse were sampled, both downstream of the proposed crossing points.

### River Great Ouse (020-FI1-092001, 020-FI1-095001)

5.4.34 The River Great Ouse is classified as a Cyprinid Water under the Freshwater Fish Directive. Both sites surveyed on the Great Ouse had a good diversity of species, predominantly consisting of cyprinid fish populations but also including the salmonid species brown trout. The upstream site (020-FI1-095001) had a high density of rheophilic coarse fish and brown trout. Combined, the sites had 12 species of fish in moderate to high density.

### Tributary of River Great Ouse (020-FI1-099001)

5.4.35 This channel was indicative of other small tributaries of the River Great Ouse found within this CFA, all of which had poor fish habitat or were dry. Habitat availability and flow are limited, and significant build-up of sediment had occurred. Two species of fish were recorded, bullhead and three-spined stickleback, indicating water quality is moderate.

## *CFA15*

5.4.36 CFA15 drains contain a number of small tributaries of the River Great Ouse and River Cherwell, as well as the main channel of the River Cherwell. All of these tributaries were classified as having relatively poor fish habitat, but fish surveys were carried out where fish populations were most likely.

5.4.37 The River Cherwell is crossed by the route near Trafford Bridge. Environment Agency data shows records of roach, common bream, a roach-bream hybrid, pike and perch.

### Tributary of River Great Ouse (020-FI1-101001)

5.4.38 This was one of two small streams to the south-east of Greatworth that were assessed as having poor to moderate habitat quality. A single stone loach was recorded during the full survey indicating a severely limited fish population at the site.

### Lower Thorpe Brook (a Tributary of the River Cherwell (020-FI1-104001)

5.4.39 A tributary of the River Cherwell drains a small catchment including Culworth and Thorpe Mandeville. The upper reaches, which will be crossed by the Proposed Scheme, had poor fish habitat with only a small number of three-spined stickleback present and are therefore of minimal fishery interest.

### Highfurlong Brook (020-FI1-113001)

5.4.40 This small tributary of the River Cherwell has a natural sinuous channel with moderate habitat present; however, lack of flow results in overall habitat being poor. Three species were recorded (three and nine-spined sticklebacks, and stone loach) in moderate densities. This suggests the reach can support a fish population; however, low flows and migratory barriers will limit a more diverse range of species.

### Boddington Canal Feeder (020-FI1-114001)

5.4.41 This channel connecting Boddington Reservoir with the Oxford canal had relatively poor fish habitat, due to its homogenous nature. Four species of fish were present with three-spined stickleback being dominant; roach and perch and nine-spined stickleback were also recorded in low numbers.

# 6 References

*Directive 2006/44/EC Freshwater Fish Directive*

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